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Abstract

Using publicly available data for a group of 20 OECD countries, we find that the cyclical volatility of the unemployment rate exhibits substantial cross-country and time variation. We then investigate empirically whether labour market institutions can account for this observed heterogeneity and find that the impact of various institutions on cyclical unemployment dynamics is quantitatively strong and statistically significant. The hypothesis that labour market institutions could increase the volatility of unemployment by reducing match surplus is not supported by the data. In fact, unemployment benefits, taxation and employment protection appear to reduce the volatility of unemployment rates. In addition, we find that the precise nature of union bargaining has important implications for cyclical unemployment dynamics, with union coverage and density having large and offsetting effects. Finally, we provide evidence suggesting that interactions between shocks and institutions matter for cyclical unemployment fluctuations. However, institutions only account for about one quarter of the explained variation, which implies that they are important but they are not the entire story.

Key words: Labour market institutions, labour market fluctuations.

JEL classification: E32, E6, J01, J08.

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Summary

The interest in how unemployment responds to output fluctuation is long-standing. Okun's rule of thumb, the empirically observed relationship between changes in unemployment and changes in output, has been a useful guide for policymakers since it was proposed in 1962. However, the relationship between unemployment and output is not stable over time and differs markedly across countries. Despite its importance, the factors underlying the response of unemployment to output fluctuations are not well understood. We investigate whether laws regulating the labour market, typically referred to as labour market institutions, can help explain cross-country and time variation in this relationship.

The sensitivity of unemployment to cyclical changes in output differs considerably across OECD countries and has changed over time in most cases. In particular, the United States, together with other Anglo-Saxon economies including the United Kingdom, Canada and New Zealand, are characterised by average values of the sensitivity of unemployment to output movements. Compared to the Anglo-Saxon economies, unemployment volatility is lower in Mediterranean countries and higher in Scandinavian economies. So can differences in labour market institutions account for this heterogeneity?

We find that labour market institutions are indeed an important factor affecting the response of unemployment rates to changes in output. The impact of most labour market institutions is found to be statistically significant; for some, such as employment protection and unions, the quantitative impact is particularly strong. In particular, we find that employment protection strongly reduces the cyclical response of unemployment. In addition, we find that the precise nature of union bargaining has important consequences for cyclical unemployment dynamics: while union coverage (the proportion of employees covered by collective agreements) significantly increases fluctuations of unemployment rates, union density (the proportion of employees who are member of a trade union) has the opposite effect. Our interpretation of these findings is that union bargaining generates real wage rigidities, whose impact increases with the spread of union agreements (union coverage). As a consequence of stronger real wage rigidities unemployment becomes more volatile. However, unions also care about job security for their members and therefore the sensitivity of unemployment fluctuations to changes in aggregate

production will decrease with density. These findings are consistent with previous results showing that union coverage is positively related with downward real wage rigidities and with evidence that union membership decreases the probability of dismissals.

The benefit replacement rate, the duration of unemployment benefits and taxation are found to have a limited impact on the sensitivity of unemployment fluctuations. All of these institutions appear to slightly reduce the cyclical response of unemployment. These results do not support the theoretical predictions that labour market institutions could increase the volatility of unemployment by reducing the available 'surplus' divided by firms and workers in the bargaining process.

Overall, we find that institutions explain about one quarter of the explained variation, which in turn is about half of the total observed variation. So, we conclude that labour market institutions are an important factor governing cyclical unemployment fluctuations, but they are not the entire story. Finally, we find some evidence supporting the hypothesis that interactions between shocks and institutions matter for cyclical unemployment dynamics.

1 Introduction

In a very influential paper, Shimer (2005) showed that the standard search and matching model is unable to generate enough volatility in the cyclical behaviour of vacancies and unemployment to match the US data. Following his work, most studies in the macro labour literature have tried to understand the determinants of cyclical labour market fluctuations, taking the US data as a benchmark. Despite all the attention that cyclical unemployment dynamics have received in recent years, very little is known about countries other than the United States. In this paper we document the cyclical behaviour of the unemployment rate for a panel of 20 OECD countries, and find substantial cross-country and time variation. We then investigate empirically whether labour market institutions can account for the observed heterogeneity in cyclical unemployment dynamics. So while the recent literature has tried to explain why unemployment fluctuates, in this paper we seek to understand why unemployment fluctuations differ across countries and over time.

Recent work on unemployment dynamics based on search and matching models suggests that there are two main channels through which labour market institutions can affect the cyclical volatility of unemployment. On the one hand, institutions such as unemployment benefits, taxation and employment protection, by reducing match surplus, should increase cyclical unemployment fluctuations. This is the amplification channel discussed by Hagedorn and Manovskii (2008). On the other hand, labour market institutions governing the bargaining of wages, such as union density, union coverage, centralisation and co-ordination in wage bargaining could affect the cyclical volatility of unemployment through their impact on wage rigidities. The role of wage frictions in the amplification of labour market fluctuations was first explored by Hall (2005) and Gertler and Trigari (2009).

We find that the United States, together with other Anglo-Saxon economies including the United Kingdom, Canada and New Zealand are characterised by average values of the cyclical volatility of unemployment relative to the cyclical volatility of GDP. With respect to the Anglo-Saxon economies, unemployment volatility is lower in Mediterranean countries and higher in Scandinavian economies. Since Anglo-Saxon economies can be reasonably considered as the benchmark of a flexible economy, these findings suggest that labour market institutions might in principle either smooth or amplify cyclical unemployment dynamics. Whether or not this is the

case is ultimately an empirical question.

The main results of our empirical work can be summarised as follows. The impact of most labour market institutions on the relative cyclical volatility of unemployment is found to be statistically significant; for some institutions, such as employment protection and unions, the quantitative impact is particularly strong. The hypothesis that labour market institutions could increase the volatility of unemployment by reducing match surplus is not supported by the data. The benefit replacement rate, the duration of unemployment benefits, taxation and employment protection are found to significantly decrease the relative volatility of the unemployment rate. In addition, we find that the precise nature of union bargaining matters for cyclical unemployment dynamics. In particular, we find that stronger union coverage significantly increases fluctuations of unemployment rates. A possible explanation for this finding is that if unions care about the real compensation of their members, collective bargaining generates real wage rigidities whose impact increase with the spread of union agreements. This interpretation is consistent with the findings by Babecký *et al* (2010), who show that union coverage generates downward real wage rigidities. On the other hand we find that higher union density significantly decreases the cyclical volatility of unemployment. This finding is consistent with evidence by Colonna (2010) and Goerke and Pannenberg (2010) who find that union membership decreases the probability of dismissals.

We assess the impact of labour market institutions on the cyclical volatility of unemployment using a fixed-effect estimation in a panel of 20 OECD countries. This methodology is standard in cross-country analysis of unemployment dynamics. Our work is therefore closely related to the empirical studies by Nickell (1997), Nickell and Layard (1999), Blanchard and Wolfers (2000), Bertola *et al* (2002) and Nickell *et al* (2005). While these authors investigate how labour market institutions and policies affect the unemployment rate in the long run, we are interested in how labour market institutions affect unemployment fluctuations at business cycle frequencies. Only few studies have used cross-country analysis to explain the behaviour of macro variables over the cycle. These works include Bowdler and Nunziata (2007) who look at the effects of institutions on cyclical adjustment of inflation; Fonseca *et al* (2007) who explore whether labour market institutions affect international GDP comovements; Rumler and Scharler (2009) who look at how employment protection legislation (EPL), co-ordination of wage bargaining and union density affect the volatility of output and inflation; Nunziata (2003), who investigates how working time

regulations affect the cyclical dynamics of employment. Perhaps the closest paper to ours is Abbritti and Weber (2010), who investigate the impact of labour market institutions on unemployment and inflation dynamics. Our paper differs from theirs in the set of institutions we use and in the empirical methodology. In contrast to Abbritti and Weber (2010) we find that higher unemployment benefits do not increase unemployment fluctuations at business cycle frequencies.

Our work is also closely related to Gnocchi and Pappa (2009). The main difference with respect to their work is in the methodology. For any institution, Gnocchi and Pappa (2009) divide countries into two subsamples, depending on whether countries feature above average or below average values for that particular institution. Next, they test whether the difference in the mean values of volatilities and correlations for the two subsamples are significantly different from zero. In this study, we assess the impact of labour market institutions on the cyclical volatility of unemployment using a fixed-effect estimation in a panel of 20 OECD countries. With respect to Gnocchi and Pappa (2009), our empirical strategy allows us to exploit both cross-country and time variation in the data, and to assess the impact of every single institution controlling for all other institutions. In line with their results, we find that institutions matter for cyclical unemployment dynamics. However, unlike Gnocchi and Pappa (2009), we are also able to quantify how much they matter. Institutions such as EPL, union coverage and union density exert a strong impact on the sensitivity of unemployment to movements in output. Overall, we find that institutions explain about one quarter of the explained variation, which in turn is about half of the total observed variation. So, labour market institutions are an important factor governing cyclical unemployment fluctuations, though they are not the entire story. Finally, we show that also interactions between shocks and institutions matter for unemployment dynamics at business cycle frequencies.

One of the limits of the previous empirical literature is that it relies on Nickell's data set which is only available until the mid-1990s, therefore restricting the analysis to a short time period. We extend the data set on labour market institutions to include more recent data and collect quarterly data from 1975 to 2009, mainly drawing from the OECD and the ICTWSS data sets, which allows us to exploit variation across countries and years to a greater degree. Finally, we use a more complete and detailed group of variables which capture the institutional characteristics of the labour market, such as union density, union coverage, centralisation and co-ordination of

wage bargaining, the replacement rate, duration of unemployment benefits, permanent and temporary employment protection legislation and the tax wedge.

The paper is organised as follows. Section 2 discusses the literature on the relationship between labour market institutions and cyclical unemployment dynamics. Section 3 illustrates the methodology and the data used for the estimation. Section 4 describes how the volatility of unemployment and labour market institutions differ across OECD countries, and how they have changed over time. The main results are presented in Section 5 and Section 6 concludes.

2 Labour market institutions and cyclical unemployment volatility

So far, there are perhaps two candidate solutions to the unemployment volatility puzzle that have been particularly successful in the literature. The first emphasises the need to calibrate the textbook search and matching model to a small steady-state surplus; the second calls for the assumption of wage stickiness. Both of these candidate solutions have important implications for the role of labour market institutions on cyclical unemployment dynamics.

Hagedorn and Manovskii (2008) show that if match surplus is small at the stationary equilibrium, even small shocks can produce large changes in the incentives to post vacancies. So anything that reduces match surplus, such as more generous unemployment benefits or higher taxation, will generate amplification in the response of labour market variables to shocks (Zanetti (2011)). The impact of firing costs instead is *a priori* ambiguous. In a model with exogenous and constant job destruction, Zanetti (2011) shows that firing costs are akin to taxes on match surplus, and as such they should also generate amplification in vacancies. By generating employment volatility on the hiring margin, firing costs should therefore increase cyclical unemployment fluctuations. However, in models where the job destruction margin is endogenous, dismissal costs will reduce employment volatility on the firing margin. The net impact will depend on which of the two margins is most affected by the policy. In a calibrated matching model of the labour market where both margins are operative, Silva and Toledo (2009) find that turnover costs should amplify unemployment fluctuations.

Labour market institutions could also affect the cyclical behaviour of vacancies and unemployment by generating rigidities in real wages. The second strand of literature that is

relevant for our analysis is therefore the one that introduces wage frictions into search and matching models of the labour market.[1] The way wage rigidities affect the transmission of shocks to the labour market depends on whether wage stickiness operates at the level of new matches or ongoing matches. Pissarides (2009) and Haefke, Sonntag and van Rens (2009) have shown that all that matters to generate fluctuations in the hiring margin is the degree of stickiness for the new hires: fluctuations in vacancies are independent of the degree of wage stickiness that is assumed for workers in ongoing matches. Intuitively, the decision on whether to hire at the margin is a function of the marginal profit, which in turn depends on the flexibility of wages for the newly hired. On the contrary, the stickiness of wages in ongoing matches might be important to explain fluctuations in the job destruction margin. In the United States most of the cyclical variation in unemployment appears to be explained by fluctuations in the hiring margin (see Hall (2006) and Shimer (2007)), but in non Anglo-Saxon economies, both the hiring and the firing margin appear to be equally important in contributing to unemployment fluctuations (see Elsby, Hobijn and Sahin (2008)). It follows that labour market institutions could contribute to explaining differences in the cyclical volatility of unemployment across OECD countries by affecting wage negotiations for newly hired workers, for workers in ongoing matches or both.

The degree of unionisation and co-ordination in wage bargaining are two institutions that might have important implications for cyclical unemployment dynamics. If unions are mainly interested in maintaining the purchasing power of the wages of their employed members, they will generate real wage rigidities in ongoing matches and amplify fluctuations in unemployment through the firing margin. If unions are also interested in ensuring that wage differentials between employees reflect differences in productivity rather than aggregate labour market conditions, they might compress variations of wages for newly hired workers (Galuščák *et al* (2010)). How unions affect wage negotiations might in principle depend also on the degree of co-ordination in wage bargaining. If wage negotiations are centralised, unions will internalise the impact of their negotiations on the macroeconomy. Therefore, if unions care about aggregate unemployment, they will absorb macroeconomic shocks through fluctuations in real wages only if the degree of co-ordination is sufficiently strong.

[1] Some studies in this literature include Gertler and Trigari (2009), Hall (2005), Hertweck (2006), Kennan (2010), Menzio (2005), Moen and Rosen (2006), and Rudanko (2009).

3 Econometric methodology and data

We analyse the impact of labour market institutions on cyclical unemployment dynamics using a data set of quarterly time series for 20 OECD countries from 1975 to 2009.[2] To facilitate comparison with search and matching models of the labour market we focus on the volatility of the unemployment rate relative to the volatility of GDP. In our baseline regression we look at output per capita, meaning that we scale GDP by working age population. The reason why we do so is because for a given participation rate and a given unemployment rate, GDP could fluctuate as a results of changes in population.

In turn, the volatility of unemployment and GDP per capita is measured by the standard deviation of the detrended series in logs and is computed over five-year non-overlapping periods, roughly equivalent to the average length of the business cycle. We detrend the data using a smoothing parameter of 1,600, a standard value for quarterly series. Specifically, our baseline regression takes the form:

$$\log\left[\sigma(u)_{it}/\sigma(y)_{it}\right] = \alpha + \beta_1 LMI_{it} + \beta_2 z_{it} + \gamma_i + \delta_t + \epsilon_{it},$$

where $i = \{1, ..., 20\}$ denotes a country, $t = \{1, ..., 7\}$ denotes a five-year time interval, u denotes the unemployment rate, y denotes output per capita and $\sigma(\cdot)$ denotes the standard deviation. LMI denotes a vector of labour market institutions, z a vector of control variables, γ_i is the fixed effect for the i^{th} country, δ_t are time-specific dummies and ϵ_{it} is an error term. In accordance with the literature, the value of a particular institution over the time interval t is set to its value at the beginning of the period.

Dependent and control variables

The unemployment rates correspond to the seasonally adjusted OECD standardised unemployment rates and conform to the ILO definition. The source is the OECD Main Economic Indicators (MEI) Labour Force Statistics data set. Quarterly data on real GDP volume estimates, seasonally adjusted, come from the OECD Quarterly National Accounts. Data on population

[2]The countries in the sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States.

between 15 and 64 years old comes from the OECD Labour Force Statistics data set. To compute real GDP per capita, we divide real GDP by the total working age population.

We use as a control the log of the standard deviation of cyclical government consumption as a percentage of GDP to proxy for discretionary fiscal policy (changes in fiscal policy that do not represent reaction to economic conditions). As shown by Fatas and Mihov (2003), governments that use fiscal policy aggressively induce significant macroeconomic instability, which is reflected in a more volatile business cycle. We control for unsystematic fiscal policy to account for potential non-linearities in the relationship between output and employment instability. For similar reasons, we also control for the standard deviation of the terms of trade and for the real interest rate. Employment in the public and private sector might respond differently to output shocks, hence we control for the share of public sector jobs. In addition, the response of both private and public sector jobs might depend on the political party in power, which is also controlled for in the estimation.

Labour market institutions

The institutional characteristics of the labour market are summarised in nine key measures: an index of employment protection legislation on permanent and temporary contracts; the benefit replacement rate and the duration of unemployment benefits; union density and union coverage; the degree of co-ordination and centralisation in bargaining; the tax wedge.

The indices of permanent and temporary employment protection legislation are indicators capturing the strictness of regulations on the use of permanent and temporary contracts, respectively. Higher values of both indicators are associated with countries having a high degree of employment protection, while low values indicate relative ease in dismissing employees.

The replacement rate is meant to quantify the generosity of unemployment insurance programmes. It shows what share of income (before tax) is replaced by unemployment benefits (before tax). The index of unemployment benefit duration is computed as the ratio of average to initial unemployment benefit replacement rate, following Bassanini and Duval (2006).

Union density is measured as the ratio of wage and salary earners that are trade union members,

divided by the total number of wage and salary earners. Union coverage is defined as the ratio of employees covered by wage bargaining agreements as a proportion of all wage and salary earners in employment with the right to bargaining. The reason for including both trade union density and union coverage in the analysis is that in some countries it is possible for most workers to have their wages set by union agreements even if the number of union members is very low. This occurs because union rates of pay are legally extended to cover non-union members both within and across firms.

The index of wage bargaining centralisation measures the dominant level at which the bargaining between employers and unions takes place, distinguishing three levels (central, sectorial, local or company) and five combinations. The index of co-ordination of wage bargaining captures the degree of consensus between the actors in collective bargaining and higher values indicate a higher level of co-ordination.

The last measure is the tax wedge, an indicator of the market inefficiency that is created when taxes are imposed on wages and it is meant to approximate the deviation of the actual wage from the competitive equilibrium as a result of taxation. Data on institutions are drawn from different sources and are generally available annually from 1975 to 2008. For a detailed definition of the institutional variables and their sources, please refer to the appendix of the paper.

4 Descriptive statistics

4.1 Unemployment rates

The first column in Table 1 shows the standard deviation of the detrended unemployment rate relative to the standard deviation of detrended GDP per capita, sorted across twenty OECD countries in ascending order. Columns two and three in the same table report the numerator and the denominator of that ratio. It is immediately apparent that there is considerable cross-country heterogeneity: the unemployment rate is nearly four times more volatile than GDP in Germany, and almost 20 times more in Switzerland. The case of Switzerland is quite striking as the relative standard deviation of unemployment is about twice as in Norway, the second most volatile country in our sample. As shown by Rogerson and Shimer (2010), Switzerland is an anomalous case, where most of the cyclical movement in total hours is accounted for by movements between

non-participation and employment at a fixed number of hours per worker. It is worth noting that the United States, and more generally all other Anglo-Saxon economies, which include Canada, the United Kingdom, Australia and New Zealand, are characterised by average values of unemployment volatility. These economies are typically considered as flexible labour markets, in the sense that their labour markets are only weakly regulated.

Mediterranean countries such as France, Italy and Portugal, exhibit low relative volatility of unemployment rates. Greece, non reported in our sample of analysis, also features a very low unemployment volatility, with $\sigma(u)_t/\sigma(y)_t = 3.3$ over the period 1975-2008. Among the group of Mediterranean countries Spain is an exception, which is likely to be due to the dual nature of its labour market, where workers on temporary contracts are subject to very high turnover policies. As we show in the next subsection, Mediterranean countries are characterised by relatively high values of employment protection. It is worth noting that Germany, another European country characterised by strong employment protection, has the lowest volatility of all countries in our sample. Scandinavian countries such as Denmark, Sweden and Norway instead, feature high volatility of unemployment rates. As we discuss later in the text, these economies are characterised by a generous system of unemployment benefits, strong union density, high taxation, as well as heavily centralised and co-ordinated wage negotiations. Overall, the statistics in Table 1 below suggest that labour market institutions might play a role in either amplifying or smoothing cyclical unemployment fluctuations.

Figure 1 shows ten-year moving averages of the relative volatility of unemployment over time. Overall, it is not possible to identify a common pattern for all countries. In some countries, such as France, Canada, Japan and Denmark, this volatility has been rather constant through time. But for most of the countries in our sample it is possible to observe considerable time variation. As already noted by Gali and van Rens (2010), the relative volatility of the unemployment rate in the United States has increased substantially through time. This relative volatility has increased also in Spain, Portugal and the Netherlands, while it has decreased in the United Kingdom, Austria, Switzerland, Italy, Sweden and Finland.

Table 1: OECD countries ranked over relative unemployment volatility			
Countries	$\sigma(u)_{it}/\sigma(y)_{it}$	$\sigma(u)_{it}$	$\sigma(y)_{it}$
Germany	3.6	9.4	2.6
Japan	4.2	6.0	1.4
France	4.8	5.3	1.1
Ireland	5.1	10.6	2.1
Portugal	5.4	10.5	1.9
Italy	5.6	7.7	1.4
Canada	5.7	9.0	1.6
United Kingdom	6.4	10.0	1.6
United States	6.8	10.9	1.6
New Zealand	7.0	11.8	1.7
Belgium	7.0	8.5	1.2
Spain	7.2	8.8	1.2
Finland	7.2	16.9	2.4
Australia	7.2	9.8	1.4
Austria	7.4	9.8	1.3
Denmark	7.7	12.8	1.7
Sweden	8.4	14.9	1.8
Netherlands	8.5	12.5	1.5
Norway	10.2	16.4	1.6
Switzerland	19.8	30.5	1.5

4.2 Labour market institutions

Figures 9 and 10 plot the percentage of employees who are members of a trade union (union density) and the percentage of employees covered by collective agreements (union coverage) ranked across countries. It is worth noting that even if the number of union members is relatively low as in France, Spain or the Netherlands, it is still possible for most workers to have their wages set by collective agreements. This happens because in some countries rates of pay negotiated by unions are legally extended to cover non-union members both within and across firms. For instance France, which is the country with the lowest union density, also is the country with the second highest union coverage. Some Anglo-Saxon countries, such as Canada and the United States, tend to have both low rates of union density and union coverage. On the contrary, Scandinavian countries tend to have both high union density and coverage. In Figure 2 and Figure 3 we present time series for union density and union coverage. In general, union density appears to be falling across years in most of the countries, while it is less so for union coverage.

The extent to which unions co-ordinate their wage determination activities is an important aspect of wage bargaining since it measures the extent to which unions are able to internalise the

externalities associated with their actions. While co-ordination among unions appears to be stronger if wage negotiations are more centralised, this does not need to be the case. For example, as shown in Figures 11 and 12, Japan has a very high level of bargaining co-ordination, despite a relatively low level of bargaining centralisation, with the bargaining ostensibly occurring at the level of individual firms. In general, union bargaining in Scandinavian countries is both relatively highly co-ordinated and centralised. Anglo-Saxon economies, including the United States, the United Kingdom, Canada and New Zealand show very little co-ordination and centralisation in wage bargaining.

Figure 4 shows that the employment protection index for permanent contracts has been relatively stable over time in most OECD countries. Most of the reduction in dismissal costs in Europe has occurred through the liberalisation of temporary contracts. Our data on temporary contracts, reported in Figure 5 for all countries, are available only from 1984 and therefore miss some important liberalisations, such as the case of Spain and Portugal. Figures 13 and 14 rank countries according to their degree of employment protection on permanent and temporary positions, respectively. These figures show that Mediterranean countries have particularly strict regulations on permanent contracts, together with some central European countries such as Luxembourg and Germany. Switzerland and Denmark have the weakest regulations in Europe, which are comparable to those in Anglo-Saxon economies such as the United States, the United Kingdom, Canada and New Zealand.

Figure 6 illustrates the tax wedge across countries and years. It is interesting to notice that in the late 1990s the tax wedge has been increasing in Mediterranean countries such as France, Italy, Spain and Portugal, and decreasing in the 1990s in some Anglo-Saxon countries such as the United States, the United Kingdom and Ireland. In Canada though, the increase in the tax wedge has been remarkable. Figure 15 ranks the tax wedge across countries. It is apparent that Scandinavian countries together with continental European countries such as France, Belgium, Germany and Italy have a relatively high tax wedge. However, Anglo-Saxon countries together with Japan and Switzerland have low levels of this indicator.

Figures 16 and 17 rank countries on the level of the gross replacement rate (the share of income replaced by unemployment benefits) and the duration of unemployment benefits. Scandinavian countries, together with some central European countries such as Belgium and the Netherlands

are characterised by the most generous systems of unemployment insurance, where unemployment benefits are high and last for long. Other countries such as Australia, the United Kingdom and New Zealand are characterised by average replacement ratios, but the duration of benefits is quite high. Figures 7 and 8 plot time series for the replacement rates and the duration of these benefits in selected groups of OECD countries. In general, Mediterranean countries as well as Switzerland and Denmark show an increase in the generosity of unemployment benefits across years. In the United Kingdom and in Canada instead, the replacement rates have slightly decreased.

5 Econometric results

Table 2 presents fixed effect results of the impact of labour market institutions on the volatility of unemployment relative to GDP per capita. The first column shows GLS fixed effect estimates in a baseline specification that includes the full set of controls. These control variables are not found to be statistically significant and are excluded in the results reported in column two. In columns 3 and 4 we present restricted specifications obtained from an iterative process in which the least significant term is deleted and the model re-estimated until all variables have a t-stat above unity, and until all variables are significant at 10%, respectively. All specifications in Table 2 below include both year effects and country effects.

The coefficients on union density and union coverage are always statistically significant, often at 1% confidence. Interestingly, they exhibit opposite signs. As we show in the following section, this result is found to be very robust. In particular, union density is found to decrease the sensitivity of unemployment rates to movements in output, while union coverage is found to increase it. These results are quite intuitive. As shown by Colonna (2010), job security is a key service that trade unions provide to their members: in this sense, union density is akin to employment protection.[3] Using British panel data, Colonna (2010) finds that union membership decreases considerably the probability of dismissals. Using German panel data, Goerke and Pannenberg (2010) reach the same conclusions. It is therefore not surprising that at the aggregate level an increase in the fraction of workers who are union members decreases the sensitivity of unemployment to fluctuations in output.

[3]The following quote appearing on the Britain's General Union's website is quite revealing:'Why join? Non-unions members are twice as likely to be sacked as members'. See web address: www.gmb-southern.org.uk/default.asp?pageid=108&mpageid=107&groupid=3.

Table 2: Regression explaining unemployment volatility relative to GDP per capita

Regression	(1)	(2)	(3)	(4)
Union density	-0.90***	-0.76***	-0.85 ***	-0.79 ***
	(0.18)	(0.16)	(0.17)	(0.15)
Union coverage	0.39***	0.35***	0.42 ***	0.32 **
	(0.14)	(0.13)	(0.14)	(0.13)
Centralisation	-0.09	-0.08	-0.09	
	(0.07)	(0.07)	(0.07)	
Co-ordination	0.09	0.13 **	-0.08	
	(0.07)	(0.06)	(0.07)	
Permanent EPL	-0.35**	-0.26**	-0.30 **	-0.28 **
	(0.14)	(0.14)	(0.14)	(0.13)
Temporary EPL	-0.10	-0.06		
	(0.10)	(0.10)		
Replacement ratio	-0.14	-0.14	-0.10	
	(0.08)	(0.07)	(0.07)	
Benefit duration	-0.17**	-0.17 **	-0.20 ***	-0.22 ***
	(0.06)	(0.07)	(0.07)	(0.07)
Tax wedge	-0.17**	-0.17 **	-0.19 *	-0.20 *
	(0.10)	(0.10)	(0.10)	(0.10)
Public sector share of empl	0.02			
	(0.02)			
Government party	0.05		-0.04	0.05 *
	(0.03)		(0.04)	(0.03)
Real interest rate	-0.03		-0.03	-0.35 *
	(0.02)		(0.02)	(0.04)
S.d. government consumption	-0.07		-0.06	
	(0.04)		(0.04)	
S.d. terms of trade	0.04		-0.03	
	(0.03)		(0.03)	
Year effects	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes
Observations	138	138	138	138
R^2	0.54	0.52	0.54	0.50

Notes: Generalised least squares allowing for heteroscedastic errors. Standard errors in brackets.

As discussed in Section 3, union density and coverage are two very different concepts. Union coverage captures the fraction of workers who are covered by union agreements. As in the case of France, it is possible that very few workers are members of a trade union, and yet union agreements cover a very large fraction of workers. On the other hand, unions also care about real wage stability for their members. This interpretation for the result that union coverage and density have opposite effects on the cyclical volatility of the unemployment rate is consistent with other empirical findings in the literature. Using a major firm-level survey containing detailed information for 15 European countries, Babecký *et al* (2010) show that union coverage is positively related with downward real wage rigidities, a measure of resistance to real wage cuts.

Neither centralisation nor co-ordination in wage bargaining appear to be significant in most specifications. Employment protection for permanent workers is instead strongly significant and

negative in all columns of Table 2. The finding that employment protection reduces the sensitivity of unemployment to changes in output is in line with the empirical findings that EPL reduces flows into and out of unemployment, rendering the labour market more sclerotic (see Messina and Vallanti (2007) and Blanchard and Portugal (2001)). From a theoretical point of view, these results are consistent with the predictions of partial equilibrium models of labour demand under uncertainty, in the spirit of Nickell (1986) and Bertola (1990). However, they do not accord well with the findings obtained in the context of search and matching models of the labour market as in Zanetti (2011) and Silva and Toledo (2009). In the latter, employment protection amplifies unemployment fluctuations by decreasing match surplus. The empirical evidence in Table 2 would seem to rule out that the Hagedorn and Manovskii (2008) effect occurs through employment protection. More in general, we find no evidence to support hypothesis that the Hagedorn and Manovskii (2008) effect operates through labour market institutions. The coefficients on the replacement ratio, the duration of unemployment benefits and the tax wedge are always found to be negative, the two latter being highly significant across all specifications.

The R^2 of our baseline specification is about 0.54, which we consider to be quite a good fit, given that our dependent variable, five year averages of quarterly standard deviations, is inevitably a very volatile measure. If we exclude institutions from the specification in column 1 of Table 2, the fit of the model drops to 0.41, which implies that institutions explain about one quarter of the explained variation. This result suggests that institutions are an important factor underlying unemployment responses to fluctuations in output, but they are not all of the story. Table 3 shows country dummies for the estimation reported in column 1 of Table 2. Many of the dummies are statistically significant at conventional levels. Interestingly, the dummies on Denmark, Finland, Norway and Sweden are strongly positive and significant at 1%, which suggests that there is something underlying the sensitivity of unemployment to output in Scandinavian economies which cannot be captured entirely by conventional indicators of labour market institutions.

In order to grasp the quantitative impact of labour market institutions we find it useful to express the estimated coefficients in terms of semielasticities. The last column in Table 4 shows the percentage change in the relative standard deviation of unemployment that is generated by a one standard deviation increase of each institution. The coefficient on permanent EPL has the largest magnitude. A one standard deviation increase in the strictness of employment protection regulation decreases the sensitivity of unemployment to changes in output by nearly 35%. The

Table 3: Country dummies

Austria	1.64*** (0.51)	Netherlands	0.64 (0.49)	(0.49)
Belgium	0.99** (0.46)	New Zealand***	0.77 (0.28)	(0.28)
Canada	-0.25 (0.37)	Norway***	1.58 (0.56)	(0.56)
Denmark	2.28*** (0.68)	Portugal	0.96 (0.62)	(0.62)
Finland	1.98** (0.61)	Spain	-0.39 (0.43)	(0.43)
France	1.08** (0.45)	Sweden***	2.48 (0.81)	(0.81)
Germany	0.11 (0.47)	Switzerland	0.29 (0.32)	(0.32)
Ireland	-0.9 (0.22)	United Kingdom	-0.88 (0.49)	(0.49
Italy	-0.23 (0.39)	United States*	0.95 (0.40)	(0.40)
Japan	-0.43 (0.37)			

Notes: The dummy variables reported in this table are based on the regression in Table 2, column (1). Standard errors in brackets.

impact of union density and union coverage is also quantitatively strong, as summarised by a semielasticity of about 18% and 9%, respectively. The impact of the tax wedge, the replacement rate and the duration of unemployment benefits is found to be statistically significant but quantitatively weak, since the semielasticities for these coefficients range from about 2% to 4%.

Table 4: Quantitative impact of labour market institutions

Institutions	Observations	Coefficient	Mean	Std. Dev.	Min	Max	Semielasticity
Union density	138	-0.90***	0.40	0.20	0.08	0.83	-17.95
Union coverage	138	0.39***	0.66	0.23	0.14	0.97	8.85
Centralisation	138	-0.09	2.62	1.19	1.00	5.00	-10.67
Co-ordination	138	0.09	3.20	1.35	1.00	5.00	12.12
Permanent EPL	138	-0.35**	2.08	0.99	0.17	5.00	-34.66
Temporary EPL	138	-0.10	2.05	1.44	0.25	5.38	-14.41
Replacement ratio	138	-0.14*	0.28	0.13	0.00	0.65	-1.81
Benefit duration	138	-0.17***	0.62	0.23	0.14	1.28	-3.89
Tax wedge	138	-0.17*	0.46	0.12	0.20	0.68	-2.03

Notes: The coefficients listed in this table are based on the regression reported in Table 2, column (1).

Robustness and sensitivity

In order to check the sensitivity of our results, we have estimated the baseline specification in column 1 of Table 2 excluding one country at a time. For every estimated coefficient, we report in Table 5 below the absolute minimum and the absolute maximum estimate. Below each coefficient, we report the country that was excluded in the estimation. The results show that union density and coverage are always negative and significant at 1% confidence, independently

of the country that is excluded in the estimation. In general, we find that all coefficients maintain the same sign that was estimated in the baseline specification. While the coefficient on benefit duration is always statistically significant, the significance of the coefficients on EPL and the tax wedge is affected by the exclusion of a particular country. In particular, the significance of the coefficient on permanent EPL is sensitive to the exclusion of Spain. The identification of the coefficient on employment protection heavily relies on the experience of the Mediterranean countries. Since there are only four of these in our sample, statistical significance requires that all of them be included. Overall, we find that the distribution of countries leading to absolute minimum and maximum estimates is quite varied, which suggests that our estimates are not driven by the behaviour of any particular country.

Table 5: Variation in the coefficients when dropping countries

Regression	Full sample	Absolute max.	Absolute min.
Union density	-0.90***	−0.98*** Sweden	−0.71*** Portugal
Union coverage	0.39***	0.51*** Sweden	0.31*** Austria
Permanent EPL	-0.35**	−0.44*** Finland	−0.15 Spain
Benefit duration	-0.17***	−0.22*** Denmark	−0.15** UK
Tax wedge	-0.17*	−0.22* Canada	−0.05 Finland

Notes: The coefficients listed in column (1) are based on the regression reported in Table 2, column (1). Absolute max. gives the largest absolute coefficient from twenty subsample regressions obtained by excluding one country at a time. Absolute min. gives the smallest absolute value. The countries in which the maximum and minima were obtained are reported below the estimates.

As a further robustness exercise we have estimated our baseline equation excluding one of the seven time periods at a time. We report in columns 1 and 2 of Table 6 below the results obtained by excluding the first and the last time block, respectively. All coefficients maintain the same sign as well as statistical significance, with the exception of the coefficient on union density, which loses significance if observations relative to the first time block are excluded. Removing observation between 1975 and 1980 takes away important information on time variation of union agreements, and matters for the statistical significance of the union density coefficient, although the estimated magnitude is virtually unaffected. Removing the last time block makes negligible difference in terms of significance and magnitude of the estimated coefficients. The results obtained excluding time blocks from two to six were very similar to those obtained by eliminating the last time period, so we do not report them.

In Table 7 we report results obtained when experimenting with alternative dependent variables,

Table 6: Baseline regression excluding time periods

Regression	(1)	(2)
Union density	-0.87***	-0.85***
	(0.21)	(0.19)
Union coverage	0.30	0.36**
	(0.19)	(0.15)
Centralisation	-0.07	-0.06
	(0.08)	(0.08)
Co-ordination	0.12	0.04
	(0.76)	(0.08)
Permanent EPL	-0.45***	-0.29**
	(0.16)	(0.15)
Temporary EPL	-0.12	-0.12
	(0.12)	(0.12)
Replacement ratio	-0.13	-0.08
	(0.09)	(0.10)
Benefit duration	-0.19***	-0.14**
	(0.06)	(0.06)
Tax wedge	-0.11	-0.19
	(0.11)	(0.12)
Public sector share of empl	-0.02	0.00
	(0.03)	(0.02)
Government party	0.04	-0.06
	(0.04)	(0.04)
Real interest rate	-0.02	0.03
	(0.04)	(0.02)
S.d. government consumption	-0.04	-0.01
	(0.05)	(0.05)
S.d. terms of trade	0.04	0.00
	(0.04)	(0.03)
Observations	119	132
R^2	0.53	0.56

Notes: Generalised least squares allowing for heteroscedastic errors. Standard errors in brackets. Estimates in the first column are obtained by excluding the first block of observations (1975-79). Estimates in the second column are obtained by excluding the last block of observations (2005-08).

namely the standard deviation of the unemployment rate relative to GDP (instead of GDP per capita) and the standard deviation of the employment rate relative to GDP per capita.[4] We denote GDP by Y, GDP per capita by y and the employment rate by n. Results obtained using $\sigma(u)_{it}/\sigma(Y)_{it}$ as dependent variable are reported in columns 1 and 2, in regressions with and without controls, respectively. Overall, we find that the estimated coefficients are very similar to those estimated in the baseline specification in column 1 of Table 2, in that coefficients for union density, union coverage, permanent EPL, benefit duration and the tax wedge, which were significant at 5% or 1% confidence are still strongly significant and retain a similar magnitude. The replacement ratio, which was only significant at 10% in the baseline model, is no longer significant, but retains a negative sign. Results for $\sigma(n)_{it}/\sigma(y)_{it}$ are reported in columns 3 and 4, which include and exclude control variables, respectively. Union density and union coverage are

[4]The employment rate is computed as the employment to population ratio. The source of employment data is the OECD Main Economic Indicator (MEI) Labour Force Statistics data set.

found to have strong and offsetting effects on the volatility of employment. These coefficients are strongly significant, in line with previous specifications. The coefficient on benefit duration is also found to be negative and significant, while other coefficients, such as EPL for permanent workers and the tax wedge are still negative in sign, but no longer significant at conventional levels. The coefficient on the replacement ratio becomes positive, but is insignificant.

Table 7: Regressions using alternative dependent variables

Regression	(1)	(2)	(3)	(4)
Dependent variable	$\sigma(u)_{it}/\sigma(Y)_{it}$	$\sigma(u)_{it}/\sigma(Y)_{it}$	$\sigma(n)_{it}/\sigma(y)_{it}$	$\sigma(n)_{it}/\sigma(y)_{it}$
Union density	-0.80***	-0.65***	-0.50***	-0.45***
	(0.16)	(0.15)	(0.17)	(0.14)
Union coverage	0.39***	0.36***	0.35***	0.28**
	(0.14)	(0.13)	(0.11)	(0.11)
Centralisation	-0.04	-0.04	-0.13*	-0.11
	(0.07)	(0.07)	(0.08)	(0.08)
Co-ordination	0.04	0.08**	0.14	0.13
	(0.07)	(0.06)	(0.09)	(0.08)
Permanent EPL	-0.36***	-0.23*	-0.05	0.00
	(0.14)	(0.13)	(0.12)	(0.10)
Temporary EPL	-0.07	-0.03	0.08	0.10
	(0.10)	(0.08)	(0.10)	(0.09)
Replacement ratio	-0.10	-0.10	0.14	0.11
	(0.08)	(0.07)	(0.10)	(0.09)
Benefit duration	-0.14**	-0.14**	-0.23***	-0.20
	(0.06)	(0.10)	(0.06)	(0.08)
Tax wedge	-0.23**	-0.26***	-0.15	-0.14
	(0.10)	(0.10)	(0.10)	(0.10)
Public sector share of empl	0.01		0.00	
	(0.02)		(0.02)	
Government party	-0.00		-0.01	0.05*
	(0.03)		(0.03)	(0.03)
Real interest rate	-0.03		0.00	-0.35*
	(0.02)		(0.02)	(0.27)
S.d. government consumption	-0.06		-0.07	
	(0.04)		(0.05)	
S.d. terms of trade	0.06*		0.06	
	(0.03)		(0.03)	
Observations	140	140	132	132
R^2	0.56	0.54	0.56	0.54

Notes: Generalised least squares allowing for heteroscedastic errors. Standard deviations in brackets. The dependent variable is the standard deviation of the unemployment relative to GDP (columns 1 and 2) and the standard deviation of the employment rate relative to GDP per capita (columns 3 and 4).

Interactions between shocks and institutions

To date, the literature on cross-country differences in unemployment dynamics has almost exclusively focussed on explaining heterogeneity in the behaviour of the mean unemployment rate across OECD countries. Most studies have tried to explain the vast divergence of unemployment experiences across OECD countries, following the economic shocks of the late

1970s (Blanchard and Wolfers (2000)). Many economists share the opinion that variation in institutions across time is not sufficient to explain the heterogeneous response of unemployment rates across OECD countries. What matters, according to these authors, is the interaction between shocks and institutions.

Ljungqvist and Sargent (1998), claim that increased turbulence, defined as increased sectorial employment reallocation, higher rate of technology adoption, or faster changes in the international economic environment is bound to generate stronger and more persistent increases in unemployment in economies with generous unemployment insurance. Den Haan, Haefke and Ramey (2001) show that various types of shocks lead to a permanent increase in unemployment only in economies where unemployment benefits and taxes are high. Blanchard and Wolfers (2000) using panel data on OECD countries provide evidence in support of the hypothesis that shocks produce stronger increases in unemployment rates in countries with highly regulated labour markets. The view that the interaction between shocks and institutions matter for unemployment dynamics has been challenged by Nickell, Nunziata and Ochel (2005), who show that an empirical model without these types of interactions is able to explain a large fraction of the observed heterogeneity in the response of the unemployment rate. In addition, they find that interaction terms between shocks and institutions are statistically insignificant and do not contribute much to explain the overall rise in unemployment.

Given the attention that interactions between shocks and institutions have received in the literature, we find it worth investigating whether they also matter for second moments in unemployment dynamics. Following Blanchard and Wolfers (2000) and Nickell, Nunziata and Ochel (2005), we estimate the following model by non-linear least-squares:

$$\log\left[\sigma(u)_{it}/\sigma(y)_{it}\right] = \alpha + \beta_1 LMI_{it} + \beta_2 z_{it} + \delta_t(1 + \sum_j \beta_{3,j} LMI_{jit}) + \gamma_i + \epsilon_{it}, \qquad \textbf{(1)}$$

where the term LMI_{jit} captures the value of institution j at time t in country i, and time effects δ_t are meant to capture aggregate unobservable shocks. This specification allows for the effects of the shocks δ_t on the relative volatility of unemployment to depend on the specific labour market institutions of a country. This dependence is captured by the parameters $\beta_{3,j}$. Columns 1 and 2 in Table 8 show the results for the specification in equation **(1)** excluding and including control variables, respectively. The model regression that excludes controls shows that interactions between most institutions and shocks are very significant, while institutions

non-interacted are not. However, introducing control variables partially changes the results, increasing the significance of non-interacted terms and reducing the significance of the interacted ones. Overall, we find some support in favour of the hypothesis that interaction between shocks and institutions matter for cyclical fluctuations in the unemployment rate, but these results are not very robust. The parameters on union density and coverage appear once again the most convincing estimates, with the former reducing the sensitivity of unemployment fluctuations to movements in output and the latter increasing it. In contrast to our expectation, the interaction between co-ordination in wage bargaining and aggregate time shocks is positive and significant, raising concerns on potential endogeneity issues.

Table 8: Explaining unemployment volatility in the OECD. Shocks interacted with institutions.

Regression	(1)	(2)
Union density	-0.53**	-1.05***
	(0.27)	(0.20)
Union coverage	0.18	0.80***
	(0.29)	(0.38)
Centralisation	0.02	-0.33**
	(0.15)	(0.13)
Co-ordination	-0.64	0.48***
	(0.18)	(0.13)
Permanent EPL	0.10	-0.25
	(0.18)	(0.16)
Temporary EPL	0.11	-0.08
	(0.19)	(0.14)
Replacement ratio	-0.04	-0.32 **
	(0.11)	(0.15)
Benefit duration	-0.18*	-0.14 *
	(0.13)	(0.16)
Tax wedge	-0.38**	-0.16
	(0.15)	(0.15)
δ_t*Union density	-0.68***	- 1.13 **
	(0.23)	(0.43)
δ_t*Union coverage	-0.98**	1.24 *
	(0.30)	(0.67)
δ_t*Centralisation	-0.54**	-0.71
	(0.24)	(0.50)
δ_t*Co-ordination	0.90***	1.05**
	(0.27)	(0.45)
δ_t*Permanent EPL	-0.12	-0.11
	(0.15)	(0.24)
δ_t*Temporary EPL	-0.58***	-0.11
	(0.24)	(0.45)
δ_t*Replacement ratio	-0.39	-0.54
	(0.25)	(0.40)
δ_t*Benefit duration	-0.04	0.14
	(0.37)	(0.52)
δ_t*Tax wedge	0.67***	0.31
	(0.22)	(0.49)
Control variables	No	Yes
Year effects	Yes	Yes
Country effects	Yes	Yes
Observations	138	138
R^2	0.58	0.55

6 Conclusions

Understanding why unemployment fluctuates is a fascinating question that has recently attracted a lot of attention. In this paper we address a related question, which is why unemployment fluctuations differ across countries. We show that this is an important topic, since the heterogeneity in the sensitivity of unemployment fluctuations to output movements is large, both across OECD countries and over time.

Differences in labour market institutions are a natural place to look for an answer to this question. As expected, we find that labour market institutions matter for cyclical unemployment dynamics; most institutions have statistically significant effects, and the quantitative impact of employment protection legislation and the nature of union agreements is particularly strong. Interestingly, we find that the precise nature of collective agreements matters for cyclical unemployment dynamics: while an increase in union membership is found to reduce unemployment fluctuations, union coverage is found to increase it. We also test for whether interactions between shocks and institutions matter for unemployment dynamics, and we find they do. But results based on interactions are somewhat sensitive to the model specification.

Overall, we find that labour market institutions account for about one quarter of the explained variation, which implies that institutions are an important factor behind cross-country differences in cyclical unemployment dynamics and their evolution, but they are not the entire story. Understanding what other factors might account for the unexplained variation remains an interesting challenge for future research.

Appendix: data and charts

Definition of the institutional characteristics of the labour market

Trade union density: the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. High unionisation is interpreted as an indication for a strong bargaining position of unions. Data source: OECD. Availability of the indicator: 1975 to 2008.

Union coverage: the ratio of employees covered by wage bargaining agreements as a proportion of all wage and salary earners in employment with the right to bargaining. Data source: ICTWSS database. Availability of the indicator: 1975 to 2007.

Index of bargaining centralisation: the dominant level at which bargaining between employers and unions over wages takes place, distinguishing three levels (central, sectoral, local or company) and five combinations. Data source: ICTWSS database. Availability of the indicator: 1975 to 2007.

Index of co-ordination of wage bargaining: summary measure reflecting whether wage negotiations take place at national, industry or firm level. The indicator ranges from one to five where higher values indicate a higher level of co-ordination. Data source: ICTWSS database. Availability of the indicator: 1975 to 2007.

Index of Permanent Employment Protection Legislation: synthetic indicator of the strictness of regulation on dismissals. The indicator used is the indicator for regular employment and it measures the strictness of regulation of individual dismissal of employees on regular/indefinite contracts. The indicator ranges from one to five: high values are associated with countries having a high degree of employment protection, while low values indicate relative ease in dismissing employees. Data source: CEP-OECD institutions data set (see Nickell (2006)) interpolated with OECD data. Availability of the indicator: 1975 to 2008.

Index of Temporary Employment Protection Legislation: This synthetic indicator captures the strictness of regulations on the use of fixed-term and temporary work agency contracts. It ranges from one to six, where high values are associated with higher employment protection. Data source: OECD. Availability of

the indicator: 1984 to 2008.

Tax wedge: indicator of the market inefficiency that is created when taxes are imposed on wages and it is meant to approximate the deviation of the equilibrium wage as a result of taxation. It is the wedge between the real cost of a worker to an employer and the real consumption wage of the worker. The measure that in this paper is equal to the sum of the employment tax rate, the direct tax rate and the indirect tax rate. Data source: Nickell (2006). Availability of the indicator: 1979 to 2003.

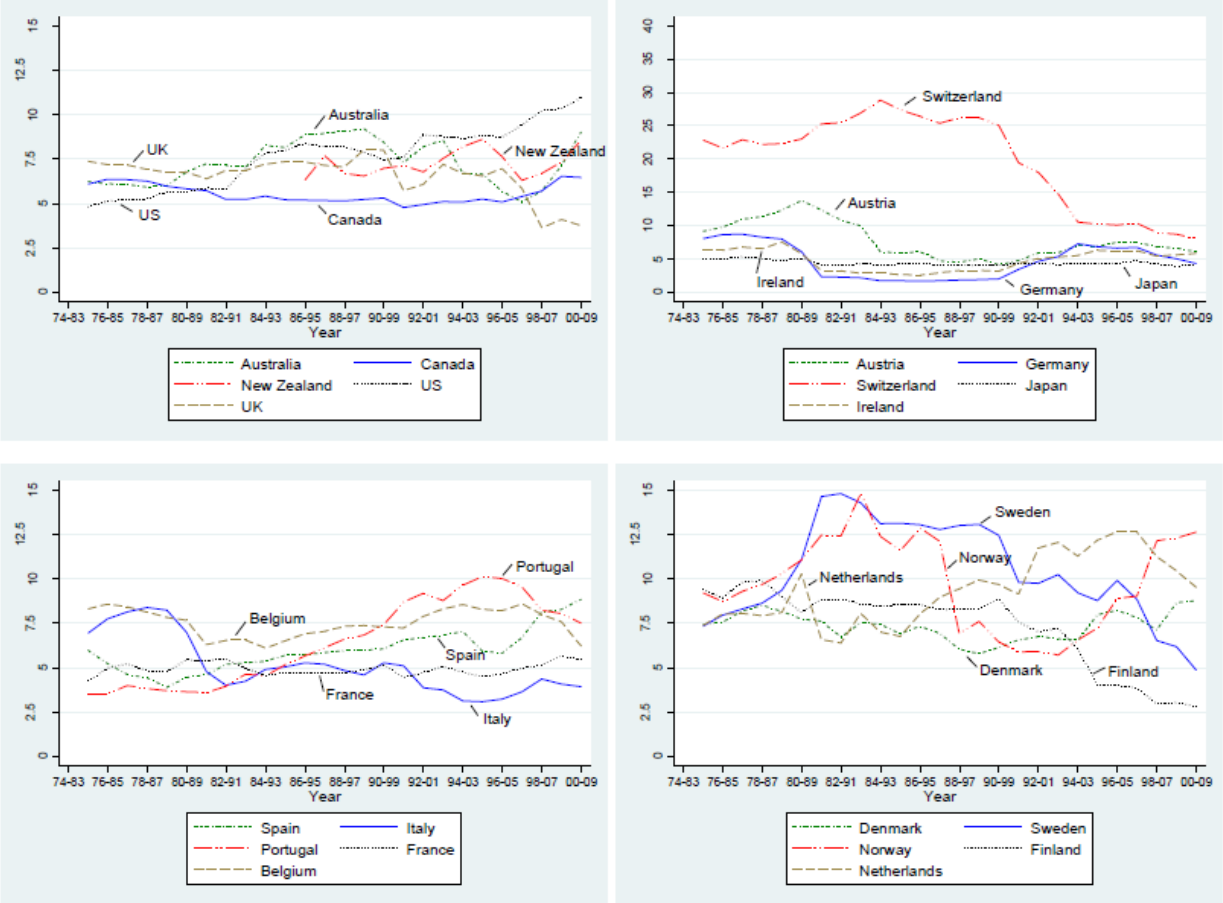
Unemployment benefit replacement rates: the average of the gross unemployment benefit replacement rates for two earnings levels, three family situations and three durations of unemployment. It shows what share of income is replaced by unemployment benefits. Data source: OECD Benefits and wages database. Availability of the indicator: 1975 to 2003.

Unemployment benefit duration: variable computed by authors following Bassanini and Duval (2006) that derived an approximation of this measure as the ratio of average to initial employment benefit replacement rate. Data source for replacement rate: OECD Benefits and wages database. Availability of the indicator: 1975 to 2007.

Table A1: Descriptive statistics for labour market institutions

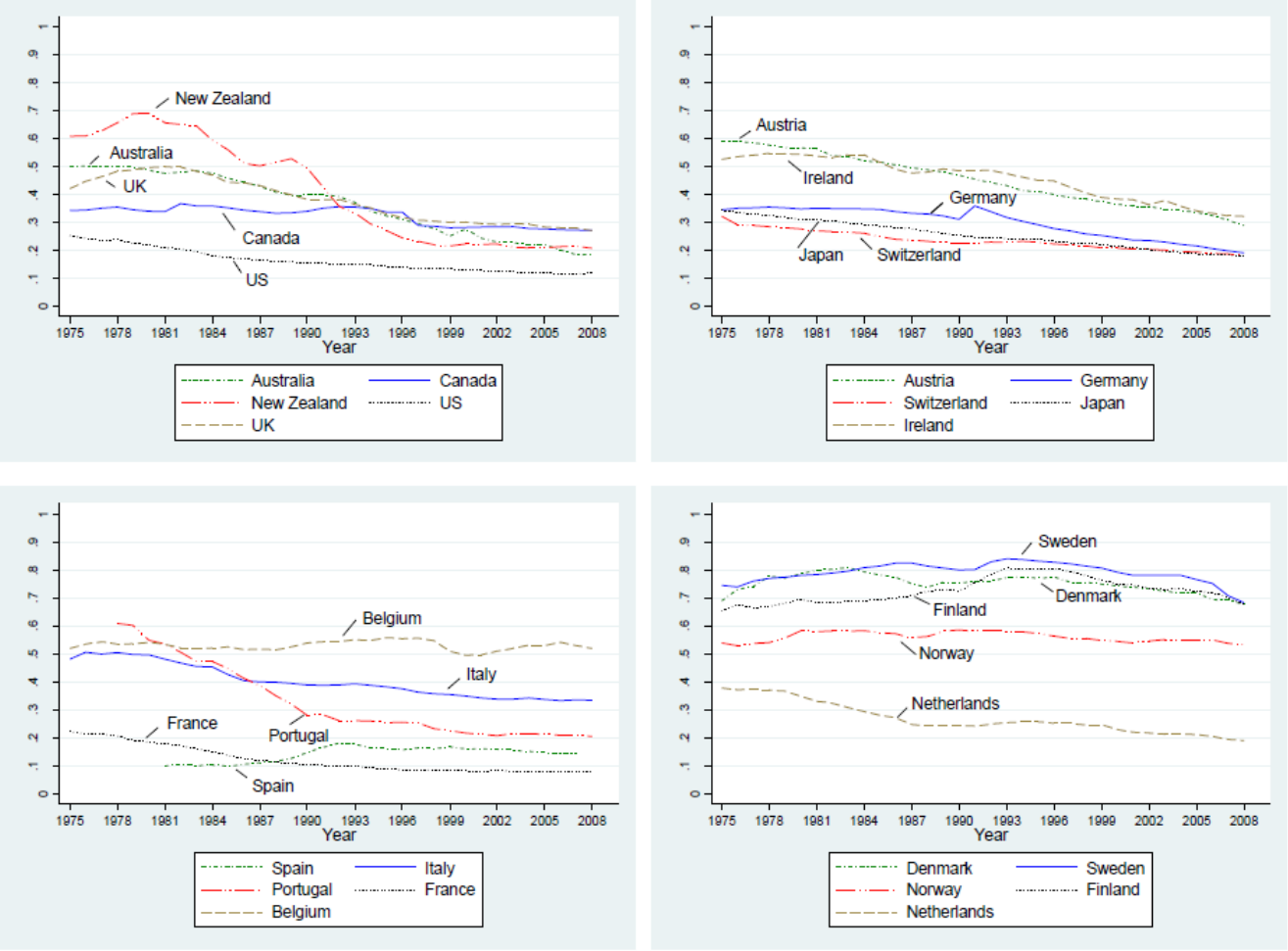
Institutions	Mean	Standard deviation	Low	High
Union density	0.40	0.20	0.08	0.83
Union coverage	0.66	0.23	0.14	0.97
Centralisation	2.61	1.18	1.00	5.00
Co-ordination	3.20	1.34	1.00	5.00
Replacement rate	0.28	0.13	0.00	0.65
Duration of benefits	0.63	0.23	0.14	1.28
EPL permanent	2.07	0.99	0.17	5.00
EPL temporary	2.03	1.44	0.25	5.38
Tax wedge	0.46	0.12	0.20	0.68

Figure 1: Volatility of unemployment rates relative to volatility of GDP per capita across countries and years



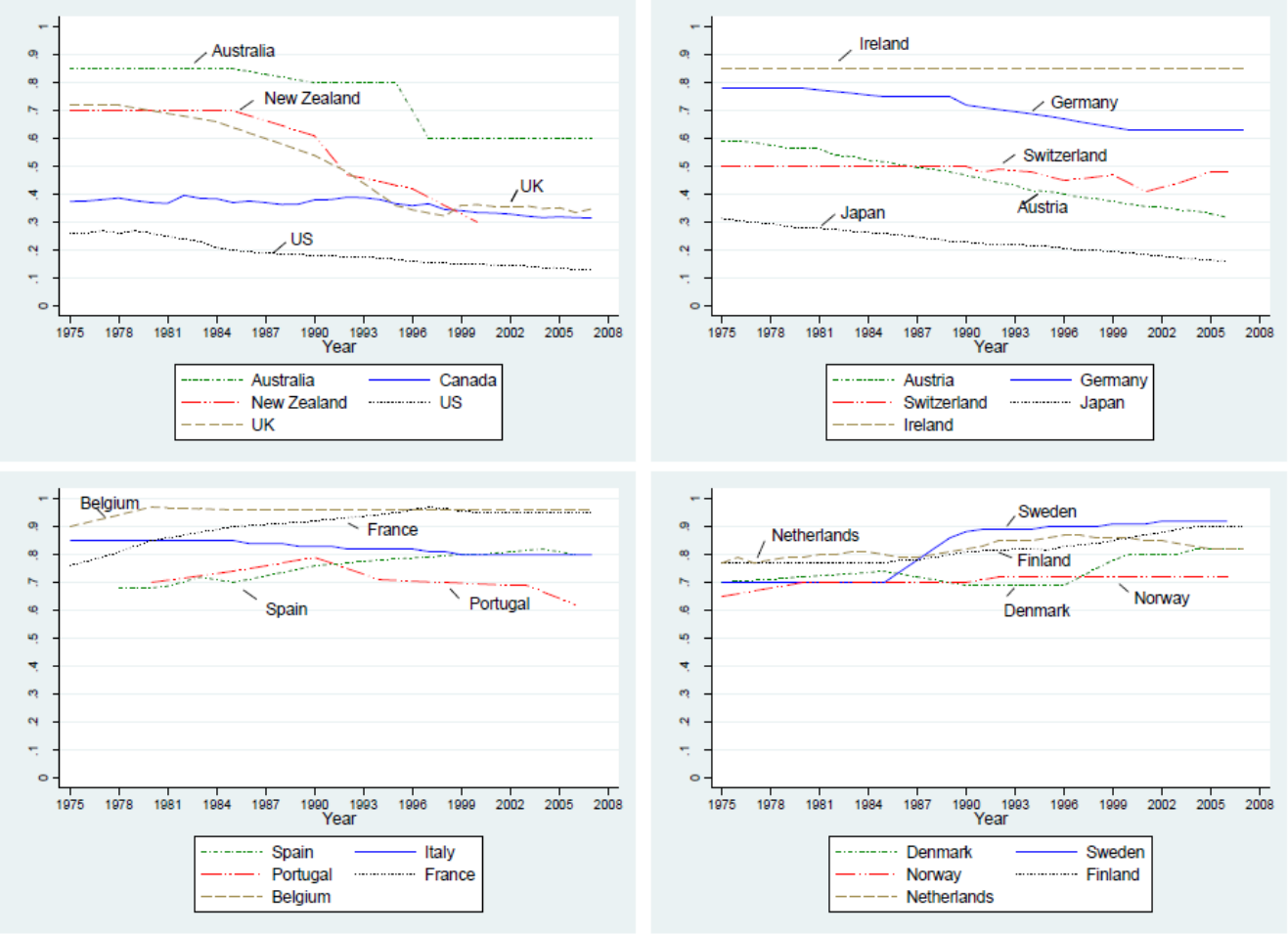
Source: OECD

Figure 2: Union density across countries and years



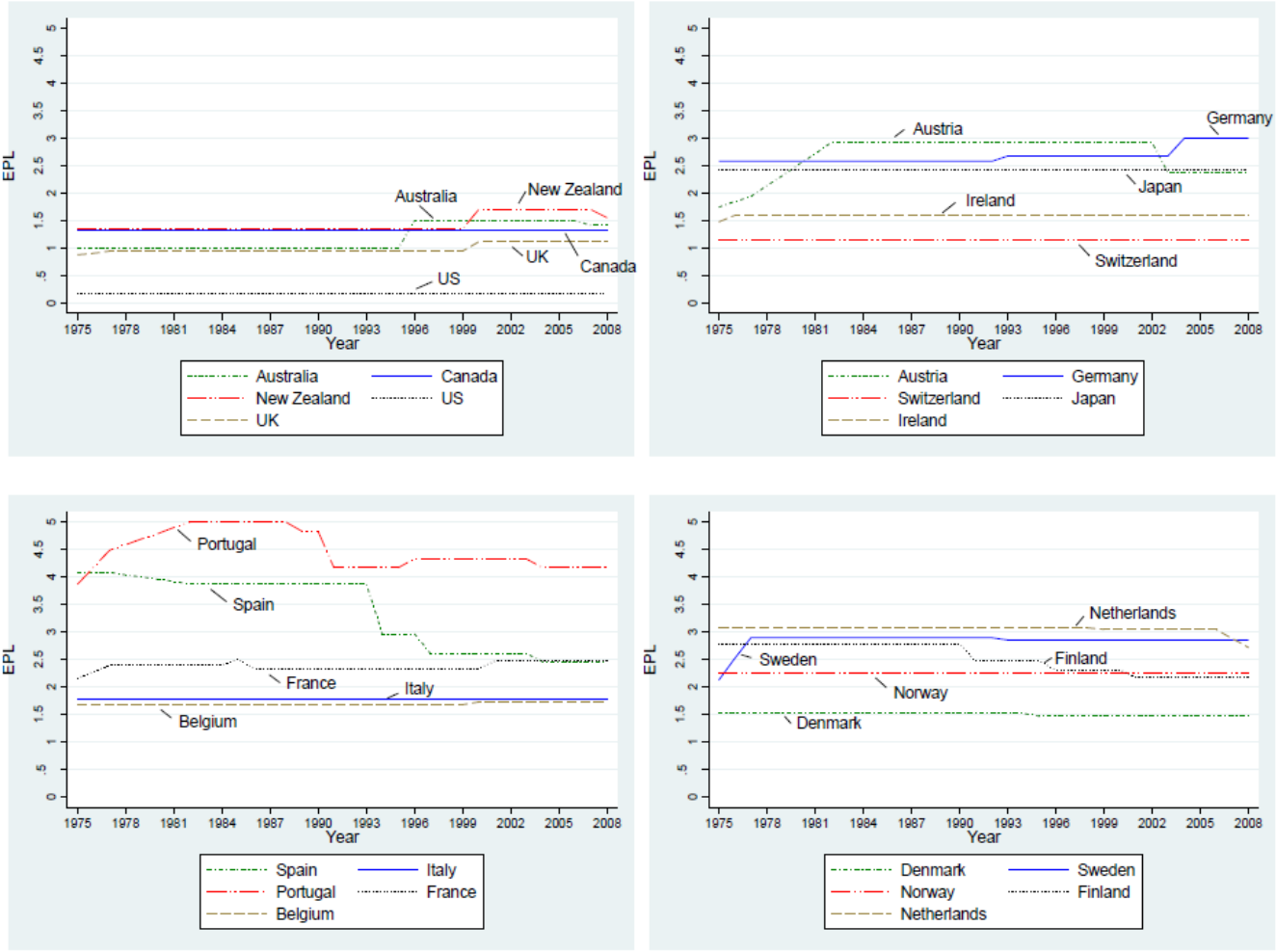
Source: OECD

Figure 3: Union coverage across countries and years



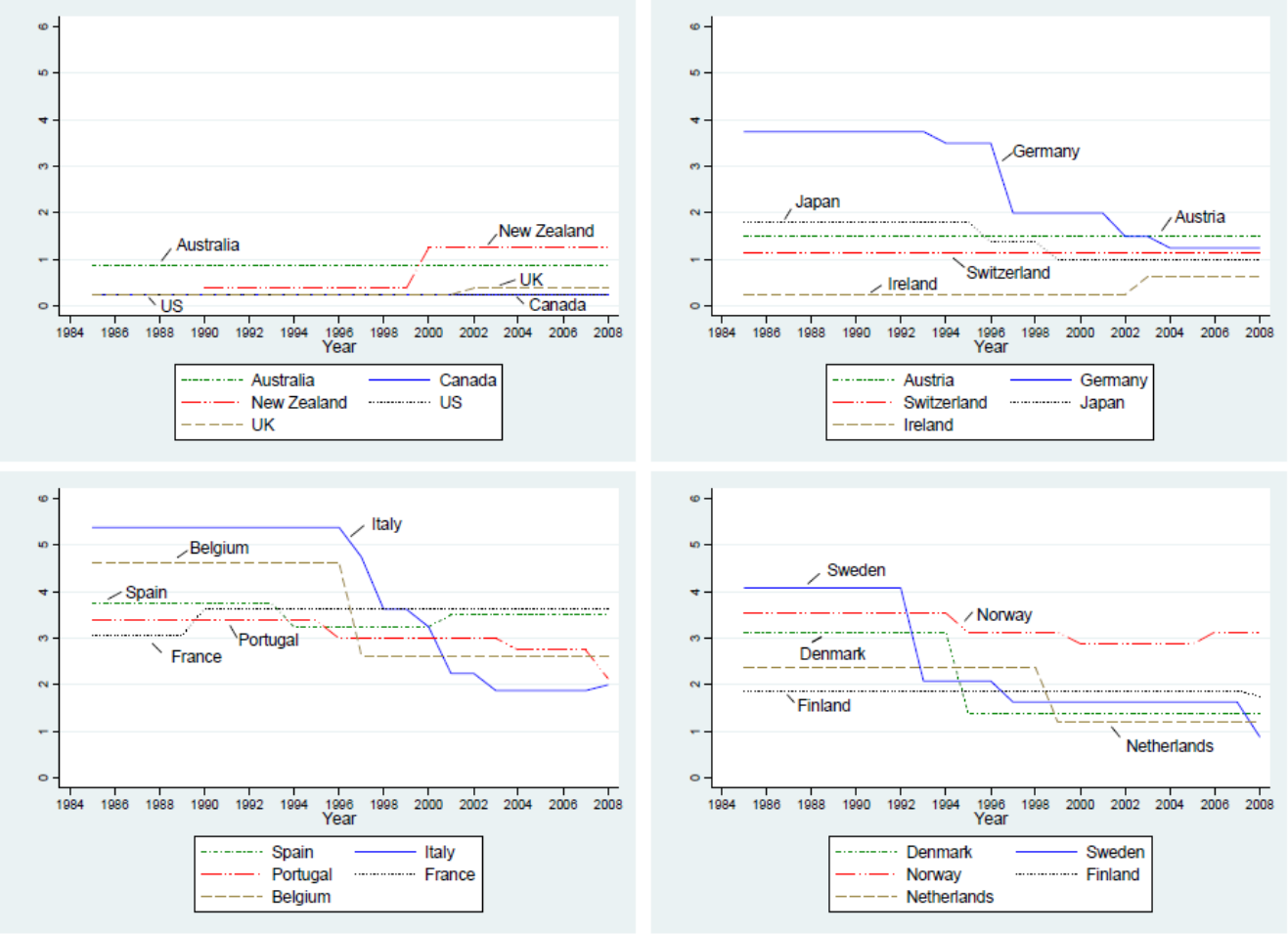
Source: ICTWSS database

Figure 4: EPL for permanent workers across countries and years



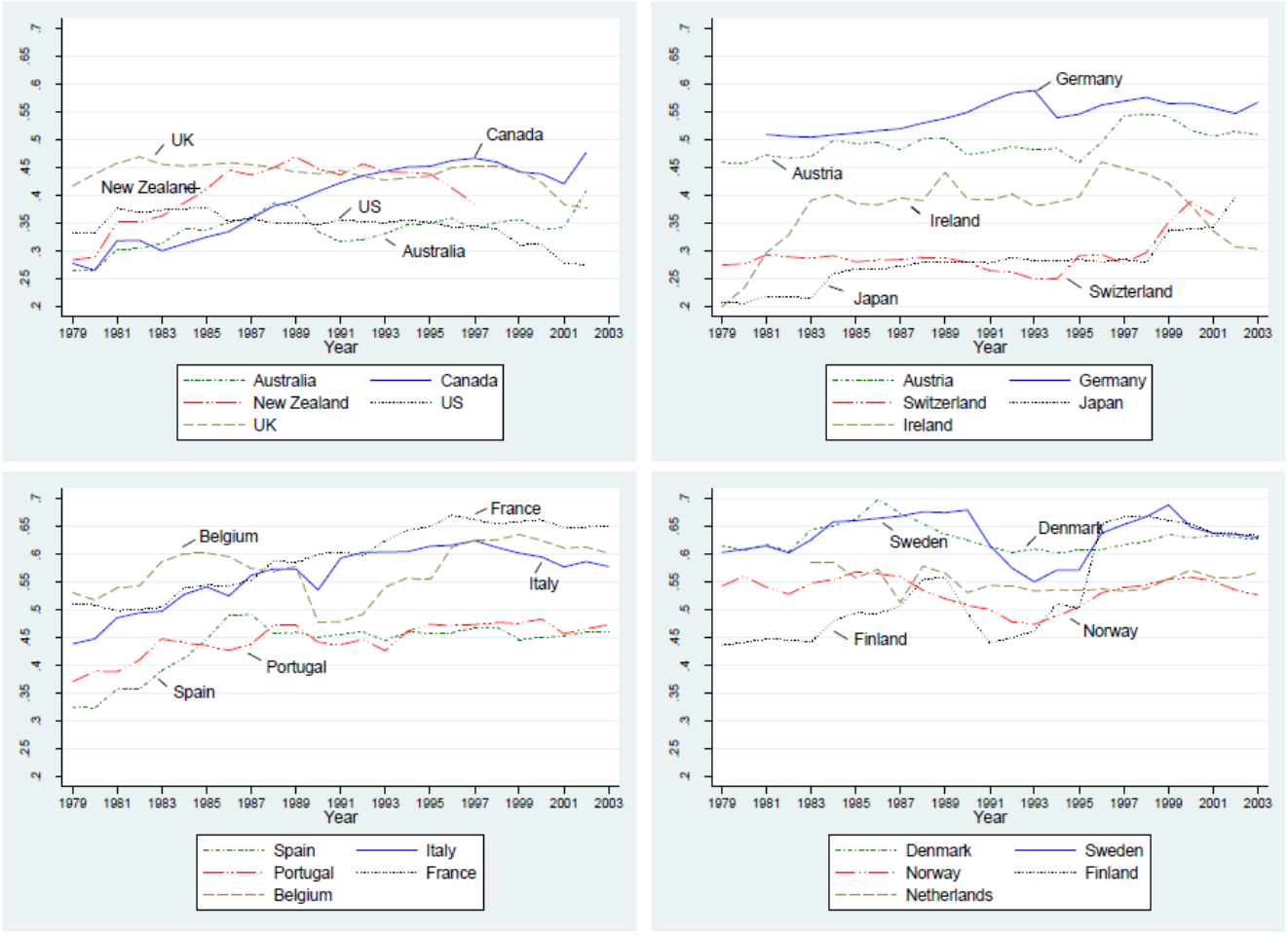
Source: CEP-OECD institutions dataset and OECD dataset

Figure 5: EPL for temporary workers across countries and years



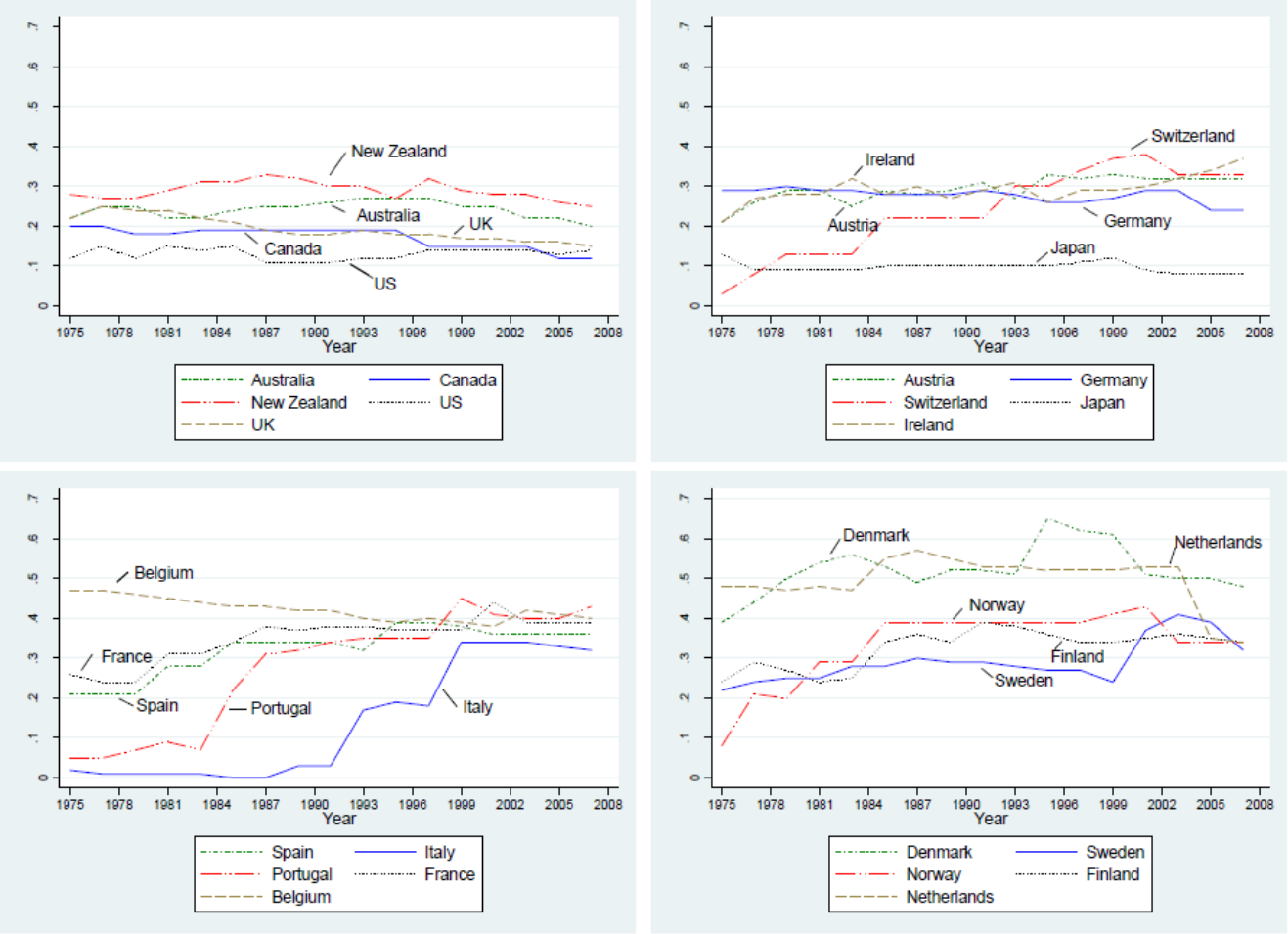
Source: OECD

Figure 6: Tax wedge across countries and years



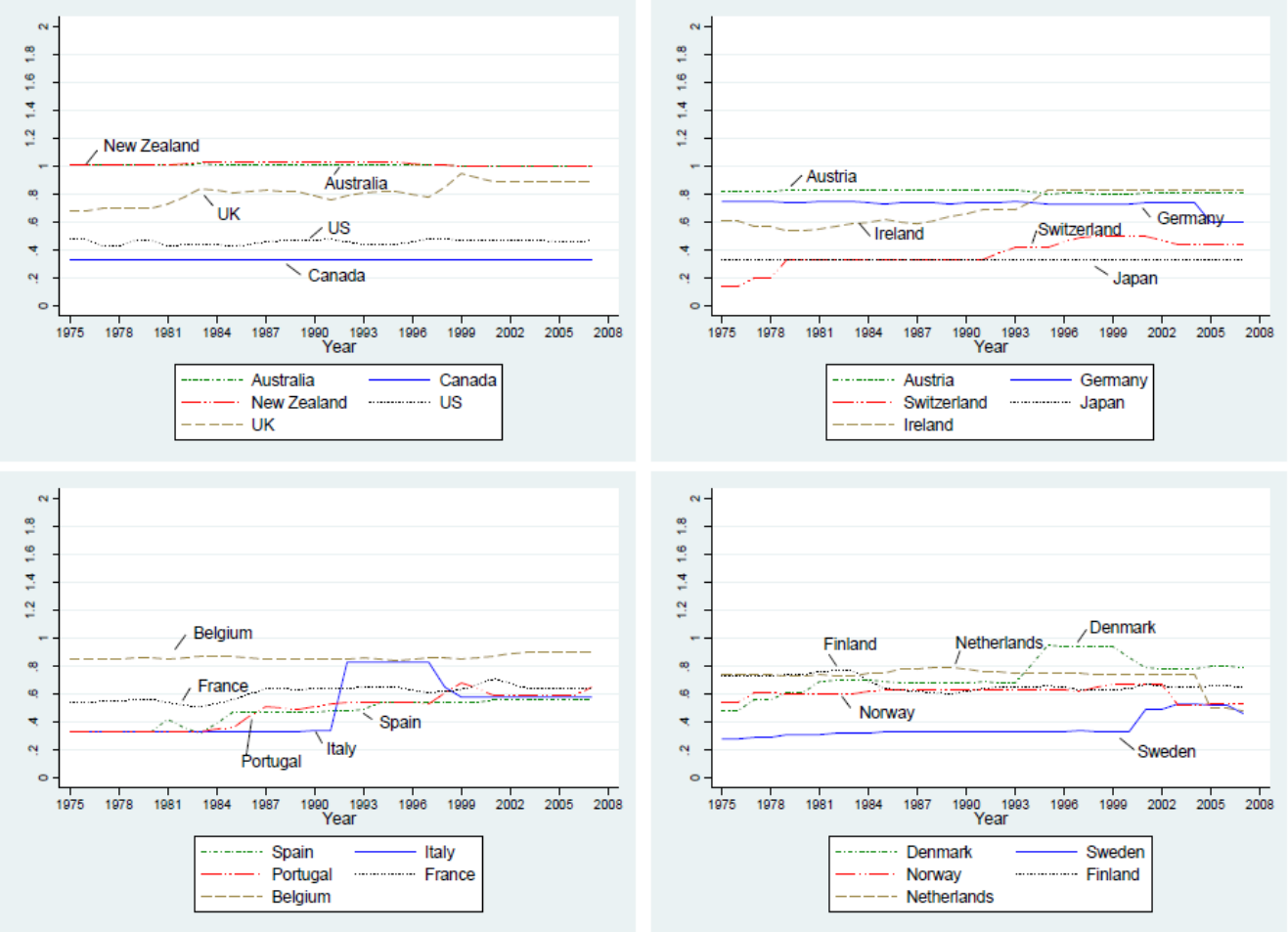
Source: CEP-OECD institutions dataset

Figure 7: Gross replacement rates across countries and years



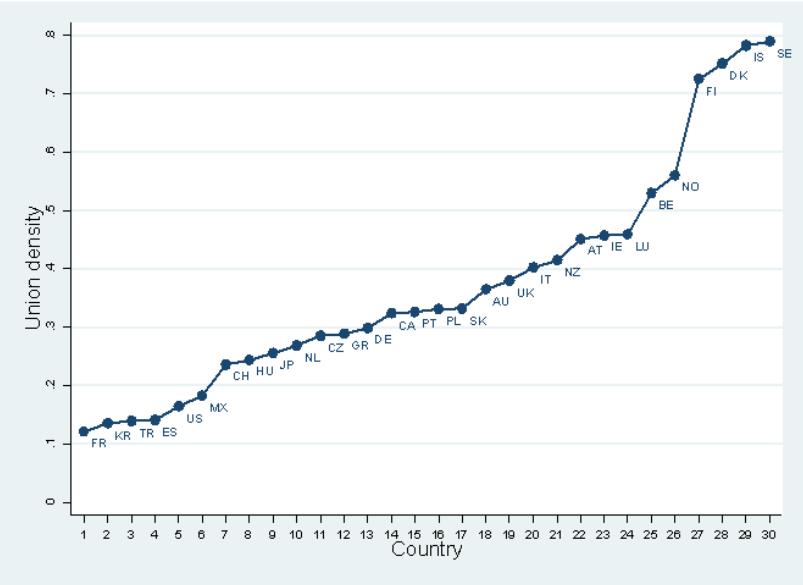
Source: OECD Benefits and Wages database

Figure 8: Duration of unemployment benefits across countries and years



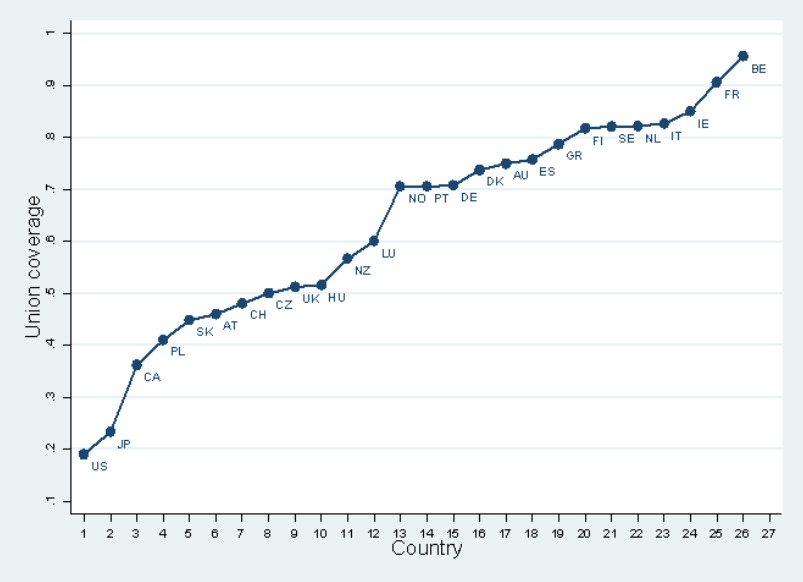
Source: OECD Benefits and wages database, authors' calculation

Figure 9: Union density ranked across countries



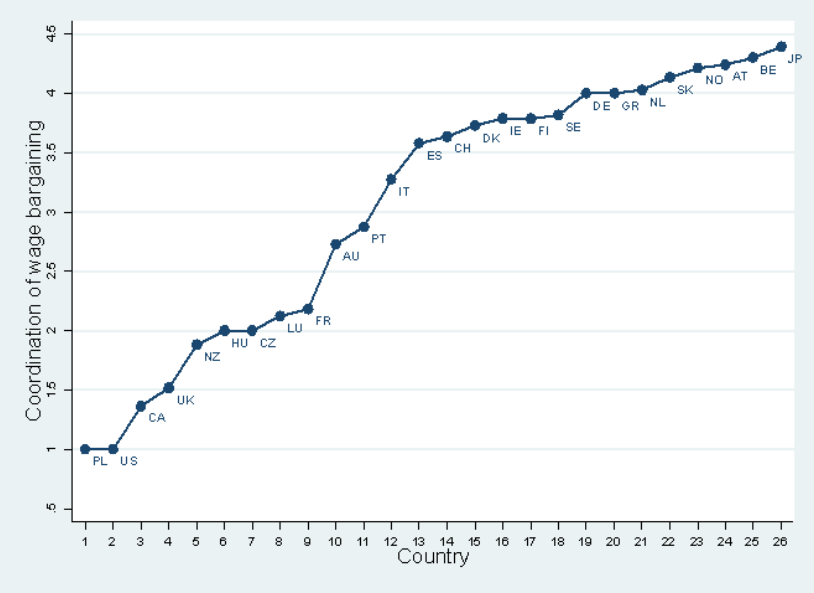
Source: OECD. Note: Australia AU, Belgium BE, Canada CA, Czech Republic CZ, Denmark DK, Estonia EE, Finland FI, France FR, Germany DE, Greece GR, Hungary HU, Iceland IS, Ireland IE, Italy IT, Japan JP, Korea KR, Lithuania LT, Luxembourg LU, Malta MT, Mexico MX, Netherlands NL, New Zealand NZ, Norway NO, Poland PL, Portugal PT, Romania RO, Slovak Republic SK, Slovenia SI, Spain ES, Sweden SE, Switzerland CH, Turkey TR, United Kingdom UK, United States US.

Figure 10: Union coverage ranked across countries



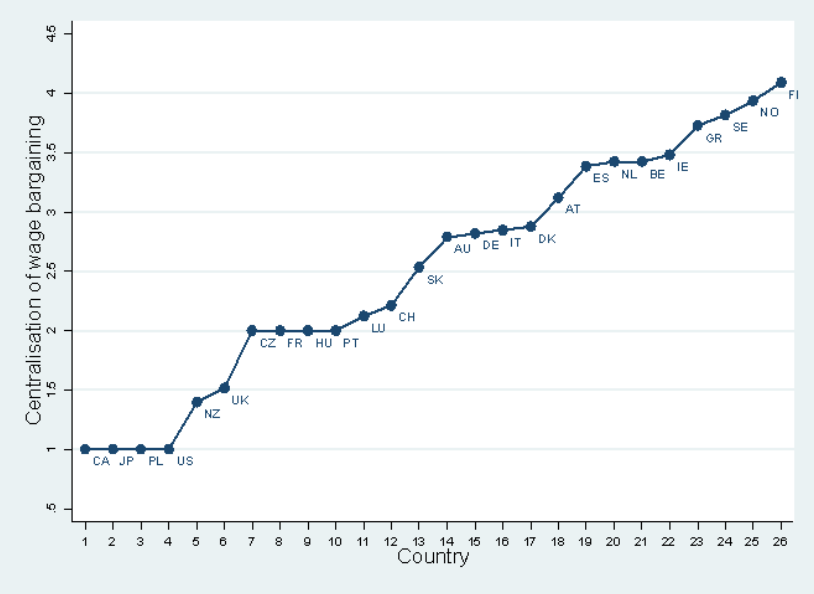
Source: ICTWSS database. Note: see Figure 9.

Figure 11: Co-ordination of wage bargaining ranked across countries



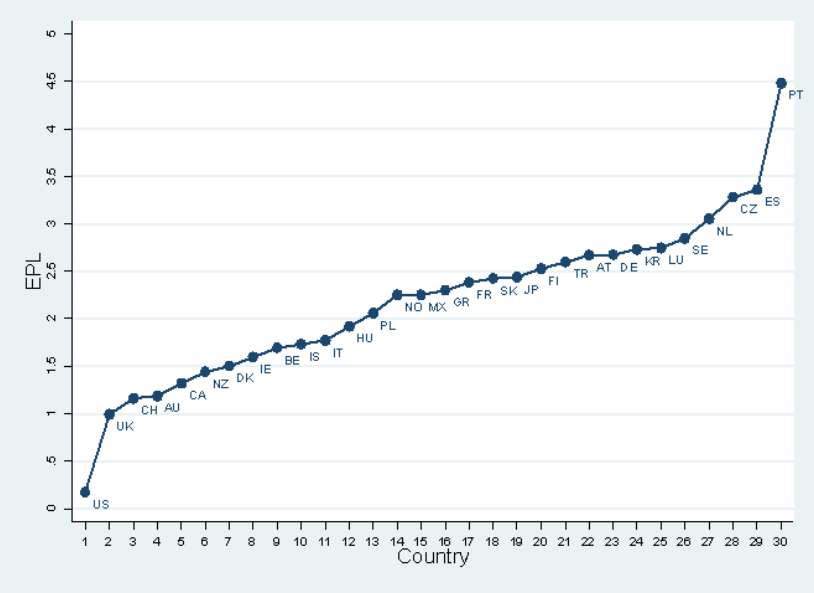
Source: ICTWSS database. Note: see Figure 9.

Figure 12: Centralisation of wage bargaining ranked across countries



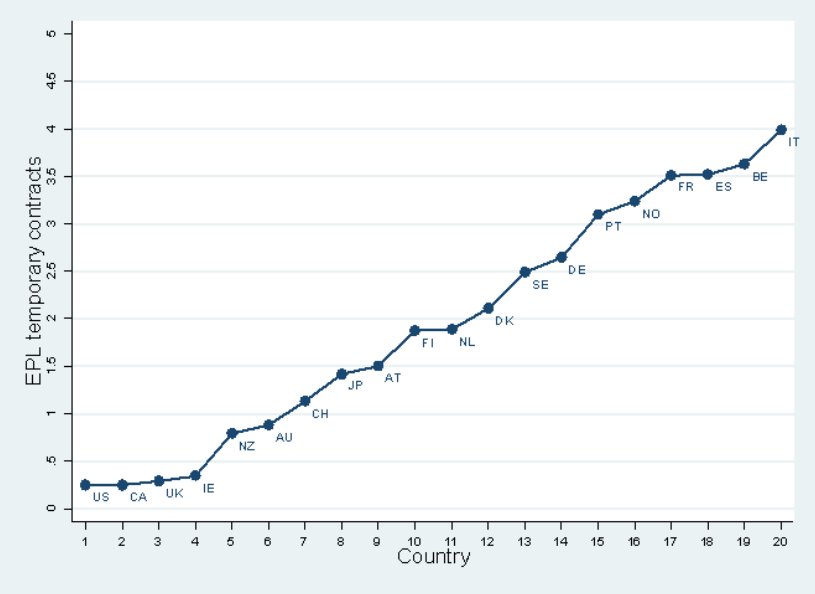
Source: ICTWSS database. Note: see Figure 9.

Figure 13: EPL for permanent workers ranked across countries



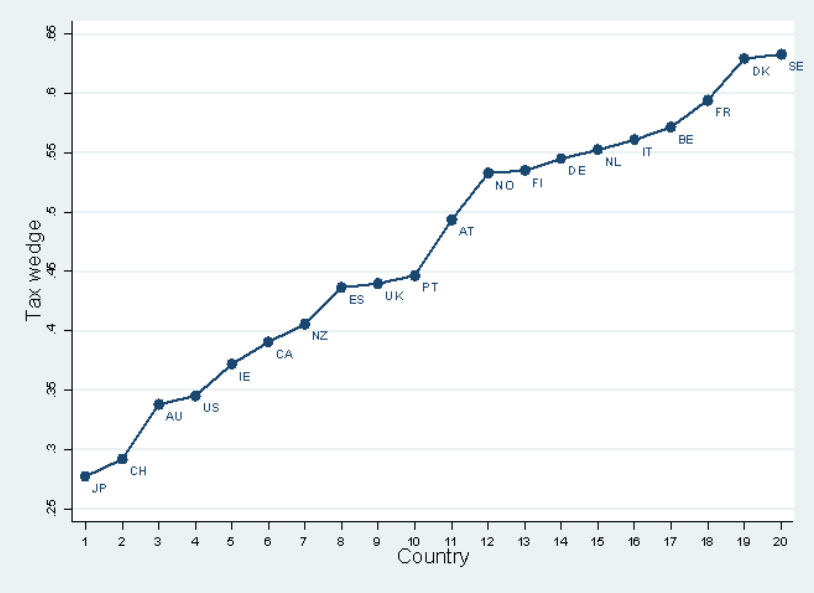
Source: OECD database. Note: see Figure 9.

Figure 14: EPL for temporary workers ranked across countries



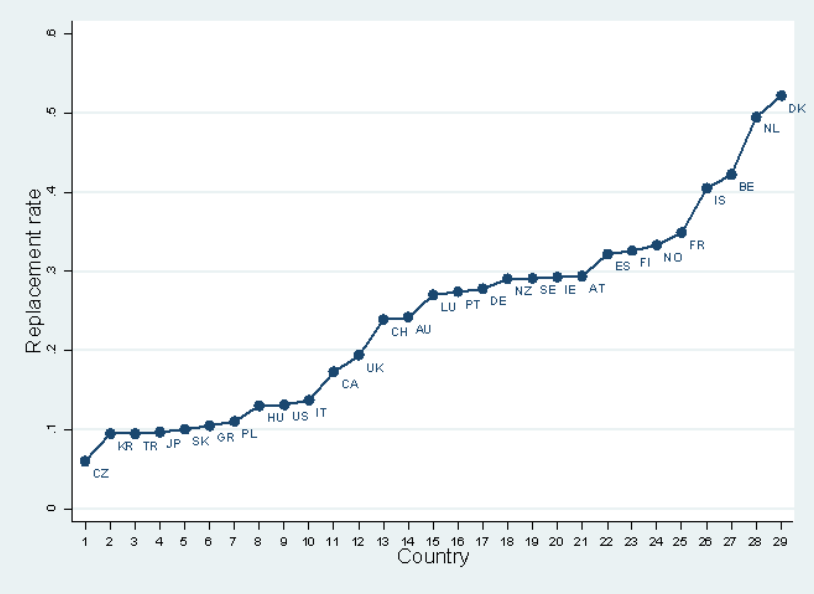
Source: OECD. Note: see Figure 9.

Figure 15: Tax wedge ranked across countries



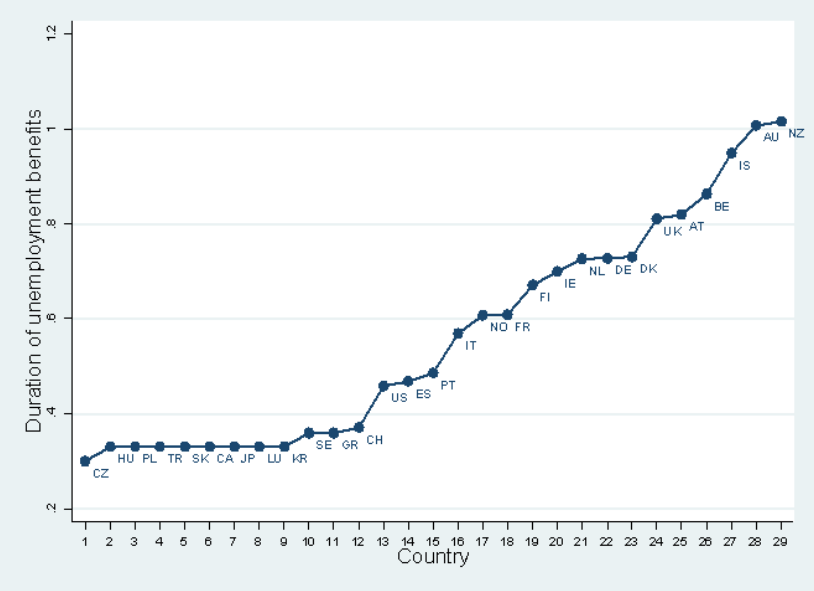
Source: CEP-OECD institutions data set. Note: see Figure 9.

Figure 16: Gross replacement rates ranked across countries



Source: OECD Benefits and wages database. Note: see Figure 9.

Figure 17: Duration of unemployment benefits ranked across countries



Source: OECD Benefits and wages database, authors' calculations. Note: see Figure 9.

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