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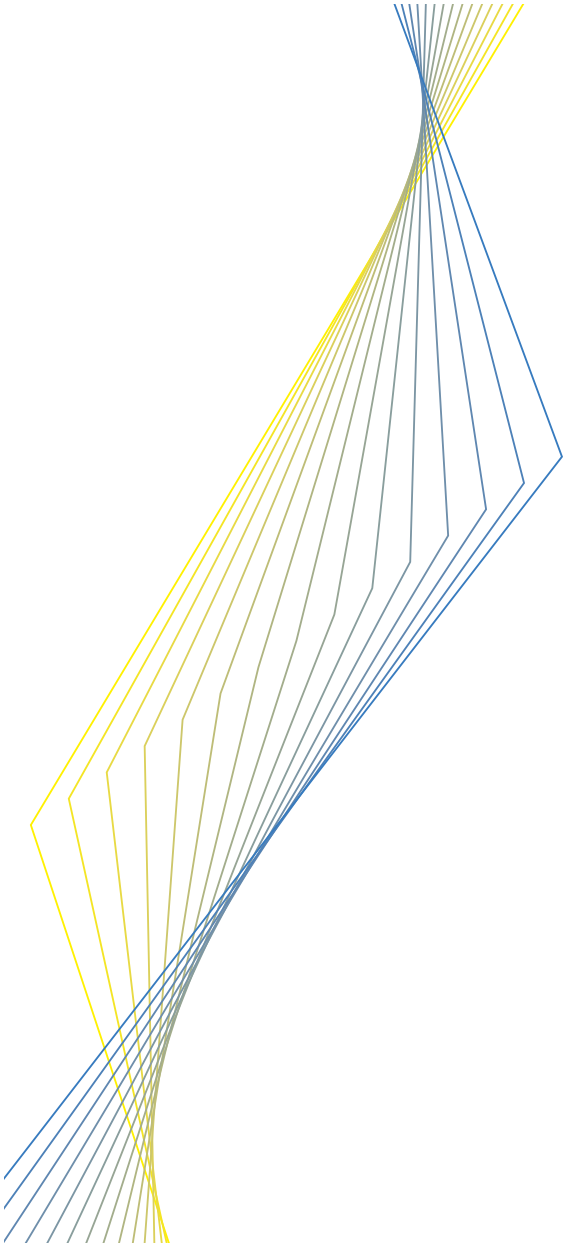

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BY JULIAN MORGAN AND ANNABELLE MOUROUGANE[1]

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Abstract

This paper examines the impact of temporal variation in labour market institutions and other structural factors on unemployment in Europe. These include the influence of trade unions, social security benefits, employment security, mismatch between job seekers and vacancies, the minimum wage and factors which drive a wedge between consumer and producer prices. With this aim, a system including a labour demand and a wage equation is estimated on pooled time-series data for the six largest EU countries for the 1980s and 1990s, allowing for country-specific fixed-effects, institutional effects and adjustment terms. Our estimates suggest that changes in regional mismatch, trade union density and the ratio between consumer and producer prices are positively associated with structural unemployment. This result is robust to a wide variety of different specifications of the model, including a larger sample of eight EU countries. No consistent role is found for the other institutional factors.

JEL Codes: E24, J30, C33

Keywords: structural unemployment, labour market institutions, panel estimation

Non Technical Summary

This paper examines the impact of labour market institutions and other structural factors on unemployment in Europe. In particular, the paper considers the influence of trade unions, social security benefits, employment security, mismatch between job seekers and vacancies, the minimum wage and factors which drive a wedge between the wage paid by employers and the wage received by employees (such as taxes, non-wage labour costs and the terms of trade).

With this aim, a system including a labour demand and a wage equation is estimated on pooled time-series data for the six largest EU countries (in terms of GDP) for the 1980s and 1990s. In the model used, labour market institutions, via their impact on wage formation have an impact on the employment decision of firms and thus in turn affect the level of unemployment. Some institutions – such as employment security – potentially have a direct impact on firms' labour demand. This approach allows the level of structural unemployment to vary over time in line with developments in the underlying structural factors.

The paper has two notable features compared with other work in this area. Firstly, it seeks to assess the impact of time-series rather than cross-sectional variation in institutional variables, whereas most previous multi-country studies have relied heavily on cross-sectional properties of the data. The emphasis on cross-sectional analysis is not surprising, as there is a paucity of data with time-series properties for many institutional and structural measures. Nevertheless, whilst recognising the limitations of focusing on the time series dimension of the data, it is of interest to see whether the results of cross-sectional analysis are supported by pooled time-series analysis. The second notable feature of the paper is that, where data allow, it tests the robustness of the results by examining the effects of using different measures of institutional variables and increasing the number of countries in the analysis.

The clearest results are that measures of regional mismatch and trade union density are positively associated with structural unemployment. This was found to be true for a wide variety of model specifications. The role of employment security was found to be ambiguous, being highly dependent on the measure chosen. In some results, unemployment benefits were found to be positively associated with structural unemployment, although the statistical significance of this factor was not robust. The tax wedge was found to have a positive and significant impact on wages only when using a large sample of countries.

The most important caveat to attach to these results is that they focus solely on the time-series dimension of institutions. There may also be some important cross-sectional effects that stem from differences in the average values of these and other variables across countries. Nonetheless, as many other studies rely heavily on this cross-sectional element, it is of interest to examine the role played by institutional variations over time.

1. Introduction

This paper examines the impact of labour market institutions and other structural factors on unemployment in Europe. These include the influence of trade unions, social security benefits, employment security, mismatch between job seekers and vacancies, the minimum wage and factors which drive a wedge between the wage paid by employers and the wage received by employees (such as taxes, non-wage labour costs and the terms of trade reflecting the use of different deflators in the workers and the employers' objective functions).

To assess the impact of these variables we utilise a Layard, Nickell & Jackman (1991) type wage bargaining framework. In this analysis, imperfectly competitive firms determine employment after a bargain over the expected real wage has been struck. The level of wages is linked to the relative bargaining strength of unions and employers, which

in turn is linked to the level of unemployment and the nature of labour market institutions. Labour market institutions, via their impact on wage formation, may therefore have an important impact on the employment decision of firms and thus in turn affect the level of unemployment. Some institutions – such as employment security – may also have a direct impact on firms' labour demand.

The most commonly used approach to examine the role of labour market institutions is to directly estimate unemployment equations as a function of institutional variables. An example of this type of analysis is provided in the paper by Nickell (1997) which is largely a cross-sectional study in that it utilises data for 20 countries and two time periods (1983-88 and 1989-94). This approach has also been used by Scarpetta (1996) and Elmeskov et al (1998) but using panel data with a significant time series dimension. Such approaches have the advantage that they can readily be extended to address other related questions such as the determinants of long-term unemployment or the labour force participation rate simply by substituting the dependent variable.

A drawback with these analyses is that they do not completely take account of other economic factors, particularly those related to the economic cycle, which determine unemployment in the short-run. To address this issue, Scarpetta (1996) and Elmeskov et al (1998) include a measure of the output gap but such a correction may render the results sensitive to the construction of a reliable measure of potential output. Nickell (1997) selects two six-year time periods in an attempt to smooth out much of the cyclical variation and also uses the average change in the inflation rate as an independent variable. However, as Nickell (1997) points out there are many potential problems of interpretation of the results when using what is effectively a cross-sectional database. These include issues of reverse causality and the exclusion of many country specific factors that could influence unemployment.

To avoid at least some of these potential pitfalls, the approach used in this paper is to estimate a model that includes all the usual 'cyclical' (or short-term) determinants of unemployment and its potential structural determinants. This model is a system including a labour demand and a wage equation and is estimated on pooled time-series data for the six largest EU countries (in terms of GDP) for the 1980s and 1990s, allowing for country-specific fixed-effects, institutional effects and adjustment terms. The method used allows the level of structural unemployment to vary over time in line with developments in the underlying structural factors. An example of this approach is contained in the paper by Barrell, Morgan & Pain (1997). In that paper the authors estimate wage and labour demand equations for each of five OECD countries for the period 1968-93 including a

range of institutional factors in the wage equations. Cotis, Meary, Sobczak (1996) also follow the same approach and estimate a wage and labour demand system for France using quarterly data for the period 1970-1995.

We also seek to assess the impact of time-series rather than cross-sectional variation in institutional variables, whereas most previous multi-country studies have relied heavily on cross-sectional properties of the data. A notable exception is the paper by Blanchard and Wolfers (2000) which uses both fixed and time-varying institutional data. The emphasis on cross-sectional analysis is not surprising, as there is a paucity of data with time-series properties for many institutional and structural measures. Furthermore, many of the variables that do exist have not shown marked changes in recent decades when there appear to have been major changes in the unemployment rate. Nevertheless, whilst recognising the limitations of focusing on the time series dimension of the data, it is of interest to see whether the results of cross-sectional analysis are supported by pooled time-series analysis. Additionally, where data allow, we test the robustness of the results by examining the effects of using different measures of institutional variables.

In the next section we briefly review the potential role of institutions and other structural factors in the determination of unemployment. We then turn to the important question of measurement and quantification of these variables and using some selected measures we compare how they have evolved over time in relation to unemployment. Following this, we describe the structural model we use and discuss empirical results based on pooled time-series data.

2. Role of Labour Market Institutions in the Determination of Structural Unemployment

Figure 1 shows developments in the unemployment rate for eight European countries in the 1980s and 1990s (see the May 2000 edition of the ECB Monthly Bulletin for a discussion of the labour market performance of the euro area). It appears that the standardised *unemployment rate*, whilst exhibiting considerable cyclical variation has shown no discernible trend in the United Kingdom, Ireland and in the Netherlands over the whole period. In contrast, a clear upward trend is evident in the case of Belgium, France, Italy, and Spain. Before 1991 Germany would have belonged to the first group while its situation now appears to be closer to the countries of the second group.

There is a wide range of institutional and structural factors that may help to explain these developments in unemployment. The actions of *trade unions* clearly have the potential to raise wages but the relationship between trade union influence and wage formation may not be a straightforward one. Powerful trade unions are more likely to secure higher wages for their members. These effects may be mitigated where the bargaining process is highly centralised and/or unions coordinate their activities with employers or with other unions as there may be a tendency to internalise some of the macroeconomic externalities that would otherwise be ignored. It is sometimes argued that a 'hump-shaped' relationship exists (e.g. by Calmfors and Driffill (1988)) whereby highly centralised or highly decentralised bargaining systems produce better outcomes in terms of wages than the intermediate systems seen in many European economies.

The generosity of *unemployment benefits* may be an important factor in the bargain over the wage. Higher unemployment benefits, especially when available for a long duration, improve the fallback position of workers in the event that they lose their jobs and hence may encourage them to push for higher wages than they would in the absence of such a safety net. It is also possible that such benefits may reduce the search effectiveness of those already unemployed, and thereby reduce their ability to put downward pressure on wages by competing with those currently employed. Either way more generous unemployment benefits may be expected to lead to upward wage pressure and thereby a rise in structural unemployment.

Employment security can play a role in wage bargaining, although the nature of this role is uncertain. Before discussing its potential role, it is important to be clear about what is meant by 'employment security'. The focus of this paper is on what Buechtemann (1993) calls *Microeconomic Employment Security*, which refers to the prospect that an individual can maintain employment within a particular firm or organisation. This represents a broad definition, much wider than that typically given to 'employment protection', which almost invariably refers to legal regulations alone. It could be argued that employment security, particularly when imposed through legislation, may worsen the so-called 'insider-outsider' problem whereby the strong position enjoyed by incumbent workers (the insiders) allows them to bid up wages despite the existence of large numbers of potential new employees in the ranks of the unemployed (the outsiders) (Lindbeck & Snower (1986)). If employment security made it easier for the insiders to secure higher wages then it may be associated with higher structural unemployment. However, according to an alternative view, wages may be lower where there is a high degree of employment security because workers may accept greater job security in lieu of higher wages (a form of 'compensating

wage differential'). Moreover, firms may wish to offset the costs associated with higher job security with lower pay. This is especially true where employers and unions bargain over job security as well as pay (Booth & McCulloch (1996)).

Another potential role for employment security is to directly affect labour demand although the relationship here is also more complex than it may first appear. Greater employment security would be expected to raise the costs of dismissing a worker, and would thereby raise the expected costs of taking on an employee and thus act as a disincentive to hiring. However, since employment security is also a disincentive to firing the net effect on labour demand is ambiguous. Indeed some writers (for example, Bentolila and Bertola (1990)) have argued that the disincentive to firing will predominate because when laying off an employee the firing costs are paid immediately but when hiring they have to be discounted by the firm's discount rate over the expected life of the employment contract.

The *wedge* between the wage paid by employers and that received by employees may have an impact on structural unemployment. The *wedge* is composed of two parts: the terms of trade and indirect tax effect (the GDP deflator divided by the consumption deflator) and the direct tax wedge. The first effect takes into account that workers are likely to have an objective for the real wage in terms of consumer prices, whilst the output deflator is more relevant for firms. The two deflators may exhibit divergent evolutions when an exogenous shock – for instance an oil price shock – hits the economy. The direct tax wedge measures all the direct taxes explaining the gap between labour costs paid by the firms and workers' compensation. These taxes include social security contributions paid by employers and employees as well as income tax. The existence of a role for such factors in explaining unemployment is essentially a question of who bears the burden of these charges in the long-run. If they are paid by employees then we would not expect them to have a significant long-run impact on labour compensation (they are included in the compensation data). If they are, at least in part, paid by employers then the tax variables may lead to higher total compensation to be paid by employers, and hence lower employment. A similar reasoning applies to indirect taxation and the terms of trade; if employees can achieve some compensation for these factors in their pay, then this will lead to higher wages and lower employment and subsequently to higher structural unemployment.

Mismatch between job seekers and unfilled job vacancies can also influence structural unemployment. Mismatch is a broad term encompassing many aspects of differences between the demand and available supply of labour. For example, mismatch may stem from a lack of spatial mobility in the labour markets (regional mismatch), or mismatch between the skills/qualifications of labour (e.g. skilled/unskilled mismatch) that may also have a sectoral dimension. A higher level of mismatch is likely to mean a higher level of structural unemployment as labour may not be easily substituted between categories – for example because of barriers to geographical mobility or because of difficulties in retraining.

There is also clearly a potential role for *minimum wages* to force up overall wages. The imposition of a minimum wage will raise the incomes of those who would otherwise be earning below the minimum threshold but it is also likely to have some impact at higher levels of income as workers attempt to, at least partially, restore pay differentials. However, as not all countries in our panel have a minimum wage, we treat this as a special case in our analysis.

There are a number of other variables that may affect structural unemployment, but, problems with data availability preclude the inclusion of many of these in the current study. The main problem is where reliable time-series data are not available and it is only possible to use cross-sectional information. Given that we have only six countries in our panel it is only possible to include variables with at least some time-series dimension. There are a number of potentially important variables that may have to be excluded for this reason. For example, there is a potential role for *active labour market measures* in improving the search effectiveness of the unemployed and hence increasing their downward pressure on wage formation (see Calmfors (1994) for the survey on the impact of active labour markets policies)). However, given the difficulty in obtaining reliable time-series data on active labour market measures, many studies have opted to use only cross-sectional information (Scarpetta (1996))[2]. The same is true for measures of the duration of unemployment benefits, which generally show little time-variation, and the range of subjective assessments of the characteristics of labour markets that are widely used in cross-sectional analysis. These include some measures of statutory employment protection (e.g. the rankings of Bertola (1990)) and measures of the degree of coordination

[2] One particular problem is that data on active labour market programmes inevitably include a large cyclical element. For example, the number of participants in schemes or total government expenditure on such programmes are likely to be considerably higher in downturns. To address this problem, Scarpetta (1996) takes the average value over the whole of the sample period (1983-93) and thus entirely forgoes the time-series dimension of the data.

of bargaining systems or the degree of centralisation of bargaining systems (e.g. as used by Layard, Nickell & Jackman (1991)).

3. Measures of Labour Market Institutions

A key issue with empirical work in this area is the measurement and quantification of labour market institutions. All of the measures used in this analysis are open to legitimate debate about whether they adequately capture the effects of the institutions or structural factors that they are intended to represent. To address this issue, wherever possible we seek to examine the effects of using other available data sources (e.g. for employment security) or different approaches to calculating each measure (e.g. for the replacement ratio).

Our measure of *employment security* in the industrial sector (ESSI) is derived from EU Commission surveys of employers (see definition in the Annex). We utilise this series, as it is one of the few internationally comparable measures of employment security to have a time-series dimension (three surveys in 1985, 1989 and 1994). In principle the measure is very broad, encompassing both statutory employment protection provisions and union negotiated employment security (Morgan et al (2001)). Over the period 1985-94 the ESSI measure declined in Belgium, France, Ireland and Italy, in all likelihood linked to the relaxation of restrictions on temporary contracts. In the remaining countries, employment security remained broadly stable over the entire period. It is noteworthy that the United Kingdom is shown to have a level of employment security consistently below that of the other countries in the sample, reflecting the weaker statutory protection for British workers.

Inevitably the availability of only three time observations for ESSI is a drawback with this series, especially as we seek to estimate a wage equation for the period 1979-97. To construct a series with a time dimension, we imposed a straight-line evolution in ESSI between survey observations and assumed that ESSI remains unchanged during the periods 1979-84 and 1995-96. Comparing the evolution of this measure of employment security with unemployment, there appears to be a weakly negative relationship during the period 1979-1997 (see Figure 2).

As alternatives, we also considered other available measures of employment security that possessed both a time-series and cross-sectional dimension[3]. Another survey based

[3] Blanchard and Wolfers (2000) also constructed a measure with a time-series dimension using OECD figures and the measure of Lazear (1990) based on the numbers of months of statutory severance pay and notice periods for a blue-collar worker with 10 years tenure.

measure is published in the World Competitiveness Report (WCR). In 1999, business people were asked to state whether: "*Labour regulations (hiring and firing practices, minimum wages…) are too restrictive/are flexible enough*".[4] The proportion of people responding that regulations are flexible enough was used as an alternative variable (therefore, in contrast with other measures, a high score indicates less employment security). Data are available on an annual basis from 1985 to 1999[5] but the sample sizes used are much smaller than for the employment security derived from the EU Commission survey. For example in 1997, around 2,500 responses were received from 'chief executives and economic leaders' covering 46 countries and giving a mean of 54 responses per country. This compares with a sample size of 23,000 industrial firms for the EU Commission survey in 1994, covering 10 countries, giving a mean sample size of 2,300 per country.

A third data source was from a paper by Nicoletti et al (1999). This paper develops summary indicators of the regulatory environment in product markets and extends the approach to the analysis of employment protection legislation (EPL). These summary indicators are constructed using factor analysis whereby a wide range of individual indicators are weighted together according to their contribution to the variance in the data. The individual indicators covered the legislative provisions for both permanent and temporary contracts, but only two time observations were available (1990 and 1997). The measure ranges from 0.5 to 3.4 and the ranking of the countries on the basis of the most recent observations from the three data series is shown in Table 1. There is a correlation coefficient of 0.84 between the scores from Nicoletti et al (1999) and the WCR, of 0.63 between the Commission and Nicoletti et al (1999) and 0.47 between the Commission and the WCR (the first and the last correlations are actually negative due to the inverse scaling of the WCR results).

The *replacement ratio* (REP) is the ratio of unemployment benefits to earnings used in the OECD Jobs Study (see description provided in the Annex). The measure used in the OECD Jobs Study is actually the average of the unemployment benefits received for three different categories of workers, two different durations of unemployment set against two different income levels as the denominator (average earnings and two-thirds of average earnings). To collapse the role of the social security system into one number is inevitably a fairly crude simplification that requires some qualification. For example, the choice to

[4] In earlier versions of the questionnaire prior to 1997 different formulations of the question were used. Between 1992-1996 the statement was "*Hiring and firing practices are too restricted by government/are flexible enough*" and from 1985-1991 people were invited to agree/disagree with the statement that "*Flexibility of enterprises to adjust job security and compensation standards to economic realities*".
[5] Data for 1987 and 1988 were unavailable.

use the earnings series as a denominator is potentially important due to the widening dispersion of earnings experienced in many countries in the 1980s and 1990s. This means that there may be important differences between both the level and the trend of a replacement ratio when measured against average earnings, two-thirds or even half average earnings. Because the unemployed may not be in a position to command average earnings, it may be more appropriate to measure their replacement income against a lower income level. To a limited extent this possibility is captured in the measure used in the OECD Jobs Study as two income levels are used. However, the potential impact of the duration of unemployment on potential earnings is not taken into account. This may matter as the perceived shadow productivity of an unemployed person may decline the longer that they are without work, and hence the value of benefits in relation to what they can expect to earn may rise.

The replacement ratio steadily increased from the late 1970s until the mid 1980s in France, Ireland and Spain and then remained broadly stable over the rest of the period. In contrast, the replacement ratio declined slightly over the entire period in Germany the Netherlands and Ireland and it decreased more markedly in the United Kingdom and Belgium. In Italy, the data are neither comparable nor reliable. The replacement rate has been historically very low because support to workers facing redundancy was provided by the system known as the *Cassa Integrazione Guadagni*. This system provided assistance to companies facing economic difficulties so they could continue to pay workers 80% of their salary (Tronti (1993)). As can be seen from Figure 2, the link between the replacement ratio and the unemployment rates in the EU countries seems to be positive.

The measure of union density used is the proportion of employees who are union members. Data are taken from the OECD (see the Annex for more details). Using, this measure, all the countries (except Spain) saw a fall in *union density rate* (UND) from 1975 to 1997 and this fall was most marked in the United Kingdom. In Ireland and Belgium, union density remained higher than in the other countries of the sample. As indicated in the scatter graph there appears to be a positive relationship between the replacement ratio and the unemployment rate.

The tax wedge has been defined as a combination of the average tax paid by employees on average earnings and the non wage labour costs borne by firms (see Annex). Data are taken from the OECD. The tax wedge has been increasing in Belgium, Germany and Italy over the period whilst it has been declining in the United Kingdom. In Ireland, an increase in the tax wedge has been followed from 1987 by a steady decline. In France, the tax wedge increased until 1995 but since then it has slightly decreased. The tax wedge has

been broadly stable in Spain and the Netherlands over the whole period. Across countries, an apparently positive relationship between the variation of the tax wedge and the variation of the unemployment rate can be observed.

The *mismatch* between job seekers and vacancies has been calculated using the sum of the relative variance of the unemployment rate by region (see Annex for more details on the construction), similar to that proposed by Layard, Nickell and Jackman (1991). Unfortunately it did not prove possible to include any element of skills or sectoral mismatch in the measure used as suitable data with an adequate time-series dimension were not available. Using this regional measure, mismatch was broadly stable over the whole period in Ireland, the Netherlands, France and Spain. Mismatch has been steadily increasing in Belgium since 1984. The United Kingdom experienced an increase in mismatch up to the end of the 1990s, followed by a gradual decline thereafter. The series has shown a marked increase in Italy and in Germany, in the latter case reaching a peak at the time of reunification. Across countries, the relationship between the variation of mismatch and the variation in the unemployment rate appears to be positive for the period 1979-1997.

4. Labour Demand, Wage Formation and Structural Factors

The analysis presented in this paper follows the "wage bargaining" framework widely associated with Layard, Nickell & Jackman (1991). Firms operate in an imperfectly competitive market and choose factors of production so as to maximise profits. Wages are bargained between workers and firms. After a wage agreement has been reached, the firm decides on the level of employment, output and prices, in line with its 'Right to Manage'. This model can be represented by a system comprising a wage and a labour demand equation.

Labour demand

With Cobb-Douglas technology and the assumption of constant returns to scale, we derive the following labour demand equation where employment is determined by output and the real wage in the long-run:

$$\ln E = b_0 + \ln Y - \ln(\frac{w}{p}) \qquad (1)$$

where:

Y - is real output

E - is employment

$\frac{w}{p}$ – is the real producer wage – deflated by the GDP deflator

As discussed in section 2, we also allow for the possibility that employment security – whether imposed through statutory regulation or negotiated by collective agreement - may affect the level of labour demand.

$$\ln E = b_0 + \ln Y - \ln(\frac{w}{p}) + b_1 ES \qquad (1a)$$

ES is a measure of employment security

As discussed in section 2, the sign on b_1 is ambiguous and will depend on whether employment security has a greater effect in deterring hiring or firing.

Wage equation

Following Manning (1993), our wage equation includes all the terms in the labour demand function and both output and employment are included with the same unit coefficient as in the labour demand equation (employment security is also included). This essentially means that wages rise in line with productivity in the long-run and in addition we include factors affecting the wage bargain. These are, the unemployment rate, the replacement ratio, the union density ratio, employment security, a measure of mismatch and the direct tax wedge. In the spirit of Layard, Nickell & Jackman (1991), we obtain the following wage equation:

$$\ln \frac{w}{p_c} = a_0 + \ln \frac{Y}{E} + a_2 INST_1 + ... + a_{k+1} INST_k + a_{k+2} u \quad (2)$$

where: $INST_1, ..., INST_k$ - are institutional variables

u - is the unemployment rate

p_c - is the consumption price

In the presence of potential nominal rigidities, stemming from the existence of wage contracts or adjustment costs, some delay may exist in the speed of adjustment of wages and labour demand. To model this, the equations are estimated in a dynamic error correction format, allowing wages and labour demand to gradually adjust to their long-run level.

Finally, we estimate:

$$\Delta \ln E = b_1[\ln E(-1) - b_0 - \ln Y(-1) + \ln(\frac{w}{p}(-1)) - b_1 ES(-1)] + b_2 \Delta \ln E(-1) + b_3 \Delta \ln Y + b_4 \Delta \ln Y(-1) + b_5 \Delta \ln(\frac{w}{p}) + b_6 \Delta \ln(\frac{w}{p}(-1)) \quad (3)$$

$$\Delta \ln(\frac{w}{p_c}) = a_1\left[\ln(\frac{w}{p_c}(-1)) - a_0 - \ln(\frac{Y}{E}(-1))\right] + a_2 u(-1) + \sum_{i=1}^{k} a_{i+2} INST_i(-1) + a_{k+3} \Delta \ln(\frac{w}{p}(-1)) + a_{k+4} \Delta \ln(\frac{Y}{E}) + a_{k+5} \Delta \ln(\frac{Y}{E}(-1)) \quad (4)$$

To derive an estimate of structural unemployment, we estimate equations (3) and (4) as a system. Since real wages and employment will, in the long-run, be determined by the terms in the error-correction common to both the employment and wage equations, changes in the structural variables and the unemployment rate will have to be offsetting. Therefore, in the long-run, only structural variables affect the unemployment rate.

It is well known that there is a potential problem of identification with the wage and labour demand equations, since by design all the elements of the long-run labour demand equation are included in the long-run wage equation. The standard way of dealing with this potential problem is to make a decision – often an arbitrary one - on some term(s) in the labour demand equation that would not be included in the wage equation. For example, some papers have deleted the productivity term from the wage equation (for example, see Manning (1993), Cotis, Meary, Sobczak (1996)). Another possible approach would have been to include some additional cost-push variables (e.g. import or oil prices) in the labour demand equation to help with identification. The feasibility of this approach was examined but unfortunately the significance of such variables in the labour demand equation was not found to be high. Another problem, as Manning (1993) argues, is that as all the variables in the labour demand equation will influence the firm's willingness to pay wages and hence they should all be included in the wage equation.

No perfect solution to this identification problem is available, but our preferred strategy for addressing this is to estimate a labour demand equation where the real wage is

expressed in terms of producer prices, whilst in the wage equation it is expressed in terms of consumer prices. The logic behind this is that the labour demand equation is seen as representing the firm's decision on its employment levels and therefore it will assess the magnitude of wages in relation to producer prices. In contrast in the wage equation which captures the outcome of the bargain between firms and union, the latter will be most concerned about the value of wages in relation to consumer prices. One consequence of this decision is that the structural unemployment rate would be directly affected by the ratio between producer and consumer prices. This means that there will be a role for factors - such as import prices and indirect taxation – that cause the two deflators to have different evolutions. However, it is important to note that this is something that is assumed in our specification.

5. Empirical Results

The approach taken was to estimate the system (3 and 4) on a pooled time-series data set for the six largest EU economies for the period 1979-97.[6] The countries in the sample were Germany, France, United Kingdom, Italy, Spain and the Netherlands - chosen because they represented a fairly homogeneous panel and because data for all the institutional variables were available for these countries. In many ways, this constituted an interesting selection of countries - including the most deregulated labour market, the country with consistently the highest rate of unemployment amongst the EU countries and a country that has recently enjoyed a major improvement in its labour market situation whilst retaining a corporatist model of labour relations. However, as discussed later, a larger and somewhat more heterogeneous panel of countries - including Ireland and Belgium - was also estimated to test the robustness of the results observed for the smaller panel.

It was necessary to instrument some of the terms in the model, although for different reasons. In order to address the potential bias in dynamic panel models with fixed effects (see Nickell (1981) or Baltagi (1995)), it was necessary to instrument the lagged dependent variable in both equations and the lagged level of the real wage and employment terms in the error-correction process (for example as $\ln \frac{w}{p}(-1)$ is contained within $\Delta \ln \frac{w}{p}$ by construction). It was also necessary to instrument the current *ad hoc*

[6] Stationarity of the variables has been tested using a Levin-Lin procedure. Results are available from the authors upon request.

dynamic terms to overcome potential endogeneity problems. The instrument set used for these variables contained the chosen variables lagged by a further two periods (i.e. $\Delta \ln \frac{w}{p}(-3)$ was used as an instrument for $\Delta \ln \frac{w}{p}(-1)$) and Durbin's procedure of using rank order of the variable to be instrumented[7]. The estimation technique used was Generalised Method of Moments (GMM), which is standard for dynamic panel models (see Baltagi (1995) for a discussion on this). The validity of the instrument set is examined using the test of overidentifying restrictions and the existence of within country serial correlation and heteroscedasticity is examined using the tests of Barrell & Pain (1999).

Our first step was to estimate (3) and (4) as a dynamic panel model with fixed-effects[8]. The results are shown in Table 2, column (2.1). There were significant and correctly signed error-correction terms in both equations and the unemployment rate term in the wage equation was significant and correctly signed. Of the institutional variables, only the mismatch measure and the trade union density measure were significant both with a positive sign indicating that they were positively related with structural unemployment.

To check this result it is important to examine whether it was a valid restriction to impose common slopes in both the wage and labour demand equations across the six countries chosen. This was the motivation for allowing a sufficiently long time-series dimension within each country, in order to allow for such a test to be undertaken. The time period chosen, 1979-97, was actually a little in excess of the availability of some of the institutional variables (for example the data on the Commission employment security series began in 1985). Series that were not available until after 1979 were assumed to have remained unchanged for the few observations at the start of the sample period. If the initial time-period chosen had been strictly limited to data availability then it would have been impossible to examine the validity of the imposition of common slopes across the panel. Clearly this is not ideal as if we had had genuine data for the missing observations then this may have affected the results of the tests for the validity of the common slopes restriction. In general, as many institutional variables evolve only slowly over time this is unlikely to have been a major problem.

We tested sequentially for the imposition of common slopes for the (1) error-correction process, (2) the institutional variables and (3) the ad hoc dynamic adjustment terms. We

[7] Maddala (1992), p.463-464 provides an overview of this procedure taken from Durbin (1954). In principle, many other instruments could have been chosen but we did not experiment with alternative specifications as this set of instruments appeared to work well.

[8] Given the existence of many country specific factors which would influence both wages and labour demand it is clearly inappropriate to adopt a random effects model for this study.

found that it was possible to impose common coefficients on the error-correction terms [Chi-Sq(15)=24.46] for the system. However, the imposition of common coefficients for the institutional terms was rejected [Chi-Sq(30)=101.33]. The imposition of common slopes for the ad hoc dynamic adjustment terms was rejected [Chi-Sq(35)=157.78]. When tested separately for the labour demand and wage equations it was found that common slope coefficients could be imposed for the dynamic adjustment terms in the wage equation [Chi-Sq(15)=20.94] but not in the labour demand equation [Chi-Sq(20)=139.84]. Reflecting the results of these tests, we allow for country-specific ad hoc dynamic adjustment and employment security terms in the employment equation and country-specific institutional terms in the wage equation. As many of these terms were not individually significant we followed the general-to-specific method of sequentially removing insignificant terms until only the significant ones remained.

The full results for our panel are described in the second column of (2.2) of Table 2. There were significant and correctly signed error-correction terms in both equations and the unemployment rate term in the wage equation was significant and correctly signed. All of the institutional variables were found to play a role in at least some of the countries. The *trade union density* (UND) variable was found to be the most significant and to have a positive sign, the latter being consistent with the findings of other studies that this variable is associated with higher structural unemployment (Nickell (1997), Scarpetta (1996) and Layard, Nickell & Jackman (1991)). However, it should be emphasised that this provides a somewhat limited assessment of the impact of trade unions. As was discussed in Section 2, a high degree of coordination amongst unions or a highly centralised bargaining process has been found to lower unemployment (for example Nickell (1997), Scarpetta (1996) and Layard, Nickell & Jackman (1991)). Unfortunately, the variables used in these studies to represent the degree of centralisation in wage bargaining have no time-series dimension and therefore cannot be used in our study. Another caveat with the union density variable is that country-specific effects were found in Spain and the Netherlands. The country-specific coefficient for Spain was negative and of a broadly comparable magnitude to the common union density variable, implying that the net effect of union density for this country was not significant. In contrast, the country-specific coefficient was positive for the Netherlands, suggesting a higher magnitude of the impact of union density than in the other countries.

The next most significant term was the *mismatch* (MISM) variable which also had a positive sign, implying that greater regional mismatch was associated with higher structural unemployment. Country specific effects were found significant for the United

Kingdom – with a negative sign- and Spain – with a positive sign. Given the order of magnitude of the coefficients estimated, the net effect of mismatch was found to be negative in the United Kingdom and positive (and stronger than in the other countries) in Spain.

Interestingly, once country specific institutional terms are added, the *replacement ratio* (REP) also appears significant with a positive coefficient. There were country-specific terms for Germany, Spain and Italy. In these countries the country-specific effect was negative and larger in magnitude than the common coefficient (see Table 8). However, in the case of Italy this result may be linked to the particular unreliability of the data, where, as discussed in section 3, the replacement ratio measure is not particularly meaningful in this case.

The measure of *employment security* taken from surveys of employers in industry (ESSI) had a non-significant coefficient in both the labour demand and wage equation. A negative, or insignificant, employment security term has also been a finding of some other studies of the determinants of structural unemployment (Nickell (1997), although not Scarpetta (1996)). Morgan (2001) also found that employment security did not lower long-run labour demand. However, there are a couple of caveats to be made here. In the case of Germany, there was a country-specific employment security effect in the labour demand equation which was negative – implying that higher employment security is associated with lower labour demand. At the same time there is a positive country-specific effect in the wage equation for the United Kingdom. In both cases these results imply that higher employment security is associated with higher structural unemployment. Overall the direct *tax wedge* term was not significant, but a negative country-specific wedge term was observed for Germany.

Robustness Tests

To test the robustness of these results we undertook three sets of checks. Firstly, we looked at the effects of changing the data series used for the institutional variables. Secondly, we examined the effects of including a variable on minimum wages for the three countries which had a minimum wage over the sample period. Thirdly, we experimented with a wider country coverage in a more heterogeneous panel. [9]

[9] We also experimented with including the first difference of unemployment. Both the contemporaneous and lagged one period change terms for unemployment proved insignificant. In the interest of parsimony these results are not reported but are available from the authors upon request.

For the measure of employment security we examined two possible alternatives to the ESSI series.[10] The first was the measure taken from the World Competitiveness Report (WCR) and the second was a measure prepared by Nicoletti et al (1999). The effects of changing measures are non-negligible, as shown in Table 3. Whilst the WCR survey measure also gives an insignificant coefficient, the Nicoletti et al (1999) measure is positively signed and statistically significant. It is noteworthy that although the overall correlation between ESSI and the Nicoletti et al (1999) measure is positive, most of this comes from the cross-sectional fixed differences between countries as the time series properties of the data are very different. The correlation coefficients within each country are actually more often negative than positive, implying very different time series properties for these series. One notable consequence of changing the measure of employment security was that this markedly affected the coefficient on the replacement ratio term. Indeed, in column (3.3) when the Nicoletti et al employment security data are used, the replacement ratio is not significant.[11]

For the replacement ratio variable we tested the effect of using a different denominator for income (shown in Table 4, column 4.1 and 4.2), either average incomes (Rep100%) or two-thirds of average incomes (Rep66%). In both cases the coefficient was positive, but in the case of Rep100% it was both larger and more significant. We also ran the same regression adding a minimum wage variable for the three countries in the sample – France, Spain and the Netherlands – which had a minimum wage over this period. As shown in Table 4 (column (4.3)) the minimum wage variable was found to have a positive sign but was not statistically significant.

Another way of testing the robustness of our results is to enlarge the sample of countries and therefore to the previous group of countries, we added Belgium and Ireland. For this larger sample, the system of equations gives broadly similar results as in the case of a smaller sample of countries as shown in Table 5. The error correction and the unemployment rate terms are still significant with negative signs.

With regard to the institutional variables, the results remain in line with those observed for the smaller sample (see Table 5). In particular, the union density and mismatch variables remain highly significant. Country specific effects continue to be visible for the union

[10] Morgan (2001) also experimented with various ways of deriving the ESSI variable from the survey data, but found that a variety of approaches had little impact on the results for a labour demand equation.
[11] These results are based on the model which included the country dummies derived when using the ESSI employment security measure (as reported in Table 2, column 2). We also undertook this robustness test for the model without country dummies reported in Table 2, column 1 but the broad pattern of results is the same as is reported in Table 3. Again, we do not report these results, but they are available from the authors.

density term (for Spain, Belgium, and the United Kingdom). In most cases, the country specific effect is negative attenuating the common influence of union trade density in these countries, but the total impact on the structural unemployment remains positive (except in Belgium). Country specific terms are significant for the mismatch variable in Germany, Italy and the United Kingdom, with a negative sign in all cases. Although lower than in the other countries, the final influence of the mismatch variable on the structural unemployment is still positive in Germany and Italy, but not in the United Kingdom.

In line with the results from the smaller sample, the employment security measure does not seem to play a major role in wage formation or labour demand behaviour for the larger sample. Nevertheless, significant country specific terms were found in the United Kingdom and Belgium in the labour demand equation, with a positive coefficient suggesting that employment security might have a positive impact on the structural unemployment in these two countries. In addition, a country specific effect in the labour demand equation was only significant for Germany, with a negative sign, as was already the case for the smaller sample of countries.

The replacement ratio appears to have a positive impact on the structural unemployment in the large sample of countries. Finally, the significance of the tax wedge term increases markedly for the larger sample of countries, with a positive coefficient. A country specific term is only present in Belgium, with a negative coefficient. All these results still hold when using alternative measures of the replacement ratio or of the WCR measure of employment security[12].

Impact of institutional variables on structural unemployment

To assess the implications of our results we calculated the implied contribution of institutional factors to changes in the structural unemployment rate. To this end we derived a parsimonious specification which included only the mismatch and union density variables as these were the only ones which were found to be reliable in the sense that they produced consistent results across the wide variety of specifications. We then followed the general-to-specific method to remove any insignificant country-specific effects.

The resulting parsimonious description of the institutional determinants is shown in Table 6. Using these results we calculated the implied change in structural unemployment due to

[12] Only the use of the WCR employment security measure was tested, given the lack of data for Ireland in the OECD measure.

the institutional factors. An important caveat here is that structural unemployment may have also been affected by other factors that have not been captured in our analysis (for instance, the minimum wage or measures of active labour market policies).

Table 7 gives details of the estimated change in structural unemployment due to each of the respective factors over the period 1979-97. These should be read in conjunction with the accompanying information on the standard errors surrounding each estimate. The results indicate that widening mismatch was associated with rising structural unemployment in Italy and Germany of around 2 and 1.5 percentage points respectively. In the remaining three countries the effects were much smaller with changes in mismatch leading to a small rise in structural unemployment in France and a small fall in Spain, the Netherlands and the United Kingdom.

With the exception of Spain there was a general decline in union density in these countries which is estimated to have contributed to a fall in structural unemployment. The effect is largest in the Netherlands where declining union density is estimated to have contributed to a fall in structural unemployment of around 11 percentage points. This is partly due to a large fall in union density but also due to a country specific term which enhanced the magnitude of the union density effect in this country. Declining union density is also thought to have reduced structural unemployment in the UK (by 7.5-8 percentage points) and in France, Germany and Italy (by 3-4 percentage points). In the case of Spain, rising union density is estimated to have led to a rise of around 3 percentage points in the structural unemployment rate.

Finally, some results are also given in Table 7 for the effects of changes in the ratio between consumer and producer wages. It should be remembered that this effect was imposed by the specification of the model whereby different deflators were used in the labour demand and wage equations in order to ensure identification. For this reason these effects are not freely estimated and it is not possible to give standard errors. Nevertheless, the magnitude of these effects is provided for information.

A noteworthy feature of these results is that for all countries except Spain, the overall effect of the changes in the institutional variables found to be significant in our analysis would tend to lower structural unemployment. However, as indicated in Figure 1, there has been a clear trend upwards in unemployment in all countries except the Netherlands and the UK. Assuming that there has not been a marked shift upwards in cyclical

unemployment over this period[13], there must therefore be some important additional structural factors which have explained the rise in unemployment. This could be due to omitted variables which could not be included because of the unavailability of data with suitable time series properties. It could also be the case that, as discussed in Blanchard & Wolfers (2000), the interaction of institutions and economic shocks has contributed to the rise in structural unemployment. Given its focus on the impact of time-series variation in a limited number of structural factors, this paper can not shed any light on this particular point. Nevertheless, the evidence from time-series data presented here – which supports that found in cross-sectional analysis – for a role for mismatch and union density should be of considerable interest.

6. Conclusions

This paper has analysed the impact of some measures of labour market institutions and structural factors on unemployment using a system of labour demand and wage equations in six EU countries. The analysis used pooled time-series data for the period 1979-97.

The clearest results were that measures of mismatch and trade union density were positively associated with structural unemployment. This was true irrespective of whether country specific institutional and dynamic adjustment terms were included, for both a smaller and a larger sample of countries, with and without a minimum wage term and when different measures of the other institutional terms were used. The role of employment security was found to be ambiguous, being highly dependent on the measure chosen. In some results, the replacement ratio was found to be positively associated with structural unemployment, although the significance of this term was not robust as it was strongly influenced by the measure of employment security chosen. The tax wedge was found to have a positive and significant impact on wages only when the sample of countries was enlarged.

The most important caveat to attach to these results is that because of the necessary inclusion of country fixed effects in the regressions and the limited number of countries in the sample, we rely solely on the time-series dimension of the institutional variables used. There may also be some important cross-sectional effects that stem from differences in the average values of these variables across countries. Moreover, the need to rely on variables

[13] This appears reasonable, as most estimates of the output gap do not report a major worsening in the cyclical position of these countries over this period.

with a time-series dimension has significantly reduced the choice of possible institutional variables that could be tested in this analysis. For example, it would have been of interest to examine the impact of active labour market programmes, other forms of mismatch, the duration of unemployment benefits on wage formation and the degree of coordination in wage bargaining. Nonetheless, as many other cross-country studies rely very heavily on this cross-country element, it is of interest to examine the role played by institutional variations over time.

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Annex: Sources and construction of the data

Data on the *number of employees* and *total compensation* are taken from the AMECO database (European Commission) except for Germany where the number of employees is taken from the OECD Labour Force Statistics and total compensation from the Deutsche Bundesbank (Saisonbereinigte Wirtschaftszahlen). The *unemployment rate* used is the OECD standardised unemployment rate.

The *employment security* measure **ESSI** is constructed from observations from the ad hoc survey of labour market flexibility undertaken by the European Commission in 1985, 1989 and 1994 (except for Spain where only the last two observations are available). In this survey firms were asked whether insufficient flexibility in shedding staff was an obstacle to taking on more workers. They were given four possible alternative responses - 'very important', 'important', 'not so important' and 'don't know'. This survey has been used to create an implied index of employment security (using a scoring system of '1' for a reply of 'very important' and '0.5' for 'important' and '0' for 'not so important' following Grubb and Wells (1993)) and this survey has been already used in empirical analysis (e.g. Morgan (2001))[14]. A paper by Morgan et al (2001) found that the responses to this survey were strongly influenced by variables measuring the legal restrictions on shedding labour (severance pay, notice periods and qualifying period for unfair dismissal), measures of trade union influence and the availability of atypical forms of employment. In order to create an annual series we fitted a straight line between the three survey observations and maintained the series as constant before 1985 and after 1994.

The term 'direct tax **wedge**' has been constructed according to the following definition following Barrell (1993):

$$wedge = \frac{(1+\frac{nwlc}{100})}{(1-\frac{tax}{100})}$$ with average *tax* paid by employees on average earnings (taken from the OECD reports on the tax benefit position of employees) and *nwlc* the non wage labour costs borne by firms (OECD). These data are available on an annual basis for the whole sample period.

[14] The index thus ranged from 0-100 to facilitate comparison with other institutional measures that are expressed as a percentage. Grubb and Wells (1993) actually used a scoring system of (2,1,0) which generated an index which ranged from 0-200.

Union density, **UND** is defined as the proportion of employees who are union members. Data are taken from Visser (1989) updated with data from the OECD. Annual observations are available up until 1985, but thereafter data are available at five yearly intervals.

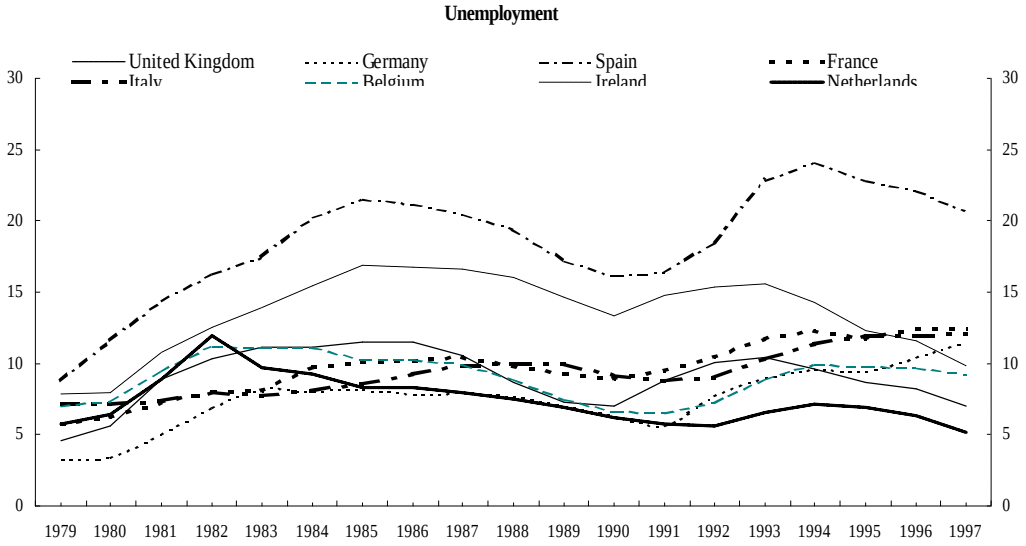
The indicator of mismatch, **MISM** is measured as the sum of the relative variance for the unemployment rates broken down by regions, using Eurostat. The details provided by Eurostat for the decomposition by regions varies according the countries. Data are available for most of the countries from 1983 onwards (except for Ireland where the series starts in 1988). The steps of the calculation are as follows. First, the unemployment rate has been divided by the total unemployment rate. Second, the variance of these normalised unemployment rates was calculated.

The *replacement ratio*, **REP** is the measure used in the OECD Jobs Study. It is calculated as the proportion of incomes that is 'replaced' by unemployment benefits. The measure used in the OECD Jobs Study is actually the average of twelve different replacement ratios for three different categories of worker, two different durations of unemployment and two different income levels as the denominator. An annual series is available for the whole period of estimation.

The data on the value of the *minimum wage*, **MIN**, as a percentage of median earnings of full-time workers were supplied by the OECD.

Tables & Figures

Figure 1 : Unemployment Rates 1979-1997 (OECD Standardised Rates)



Source: OECD

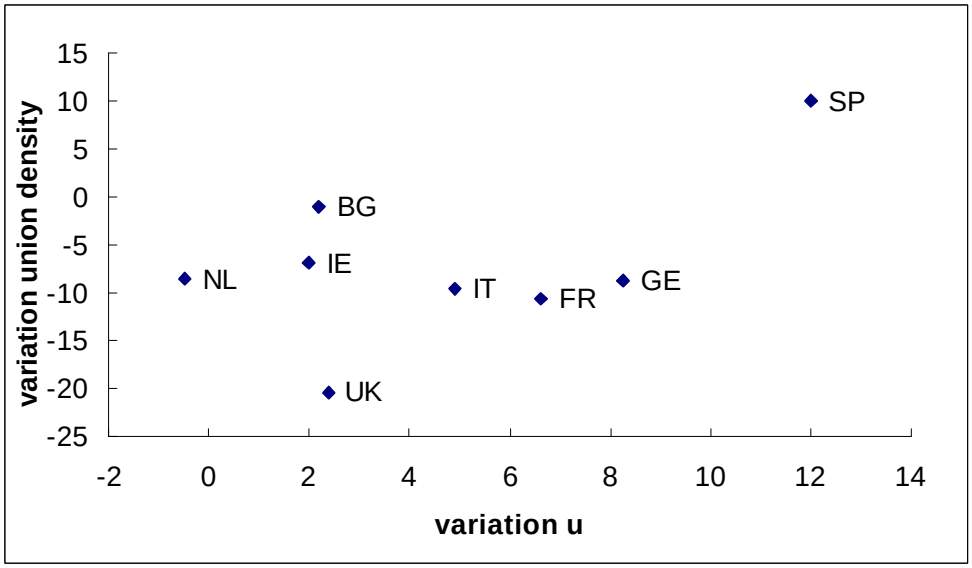
Table 1: Ranking of Countries by Employment Security Measures

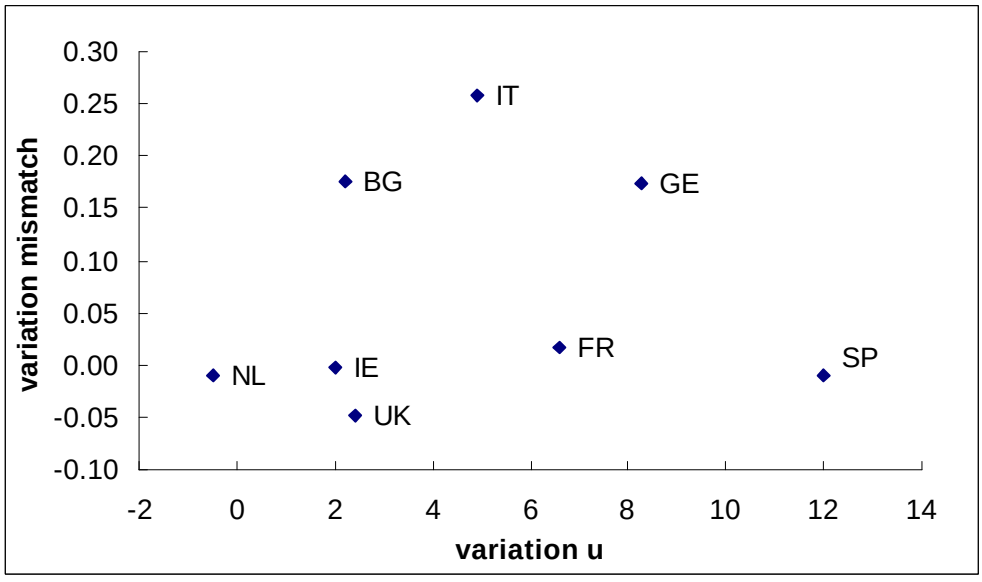
(1=highest employment security, 8=lowest)

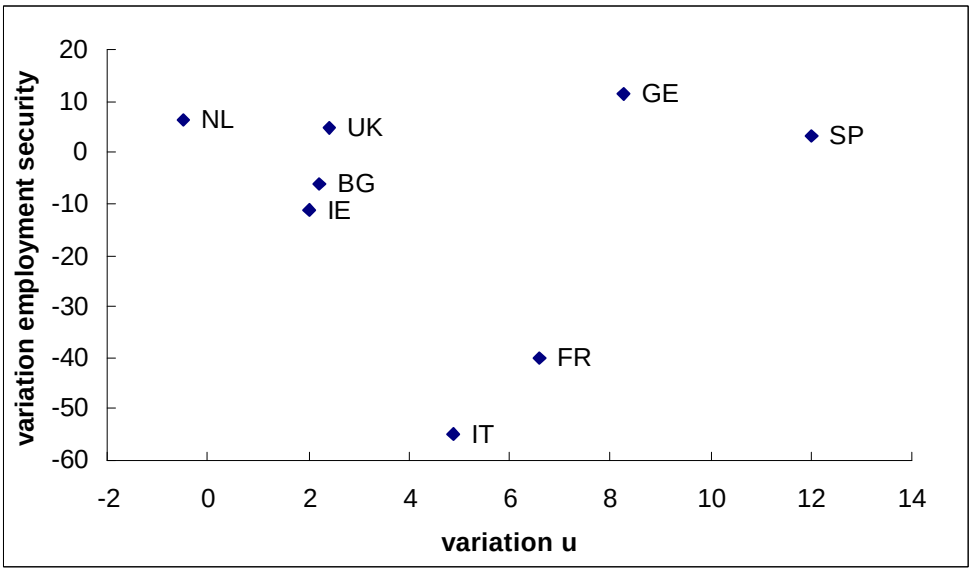
	ESSI (1995)	**WCR (1999)**	**Nicoletti et al (1999)**
1	Spain (128.8)	Italy (2.13)	Italy (3.3)
2	Belgium (106.7)	Germany (2.31)	Spain (3.2)
3	Ireland (100)	France (2.42)	France (3.1)
4	Italy (96)	Belgium (3.19)	Germany (2.8)
5	Germany (94.8)	Spain (4.23)	Netherlands (2.4)
6	France (94.3)	Netherlands (5.06)	Belgium (2.1)
7	Netherlands (79.3)	Ireland (6.15)	Ireland (1.0)
8	UK (44.2)	UK (6.6)	UK (0.5)

Using the latest available observations
ESSI - based on EU Commission Surveys
WCR - Taken from the World Competitiveness Report

Figure 2 : Unemployment rate variation and institutional variables variation (1979-1997)



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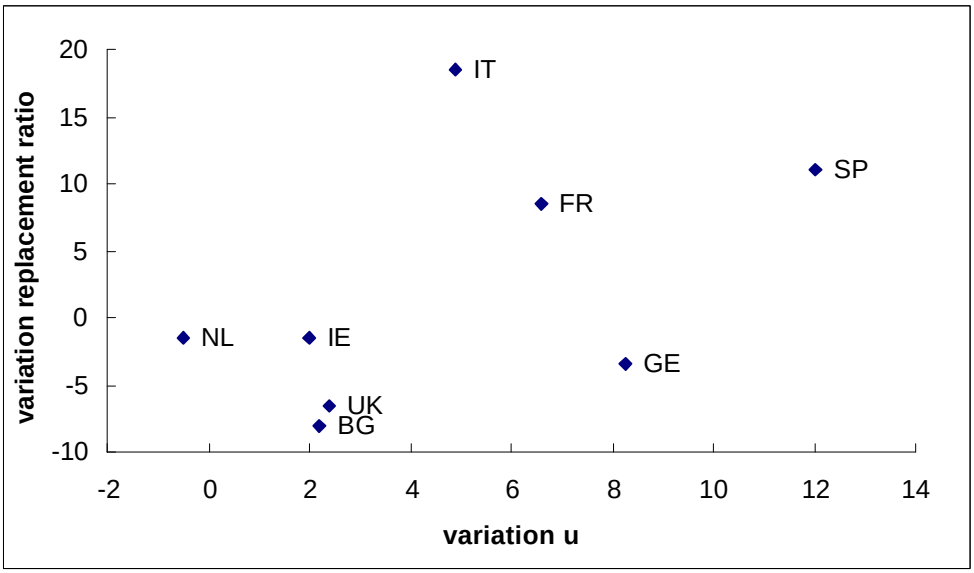
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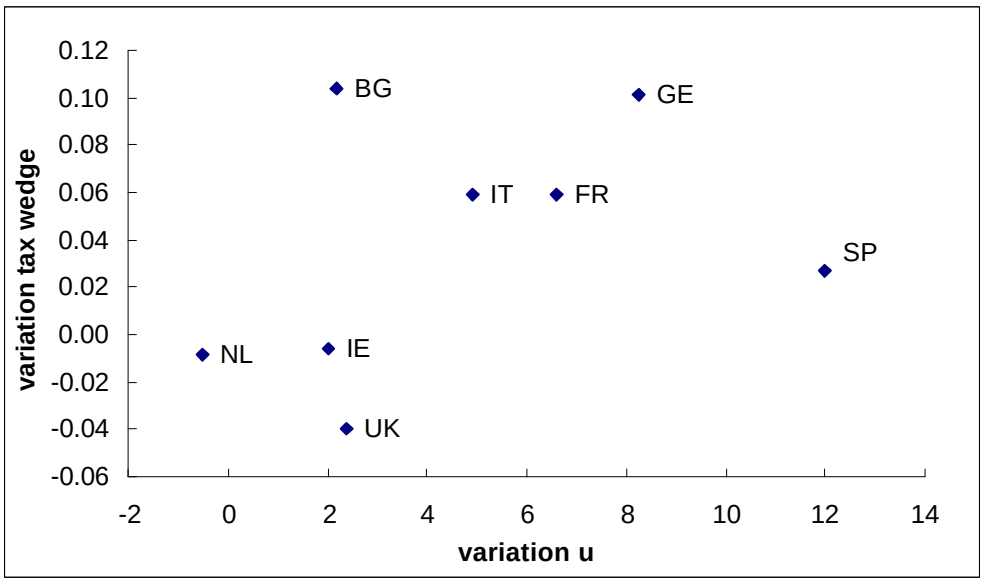

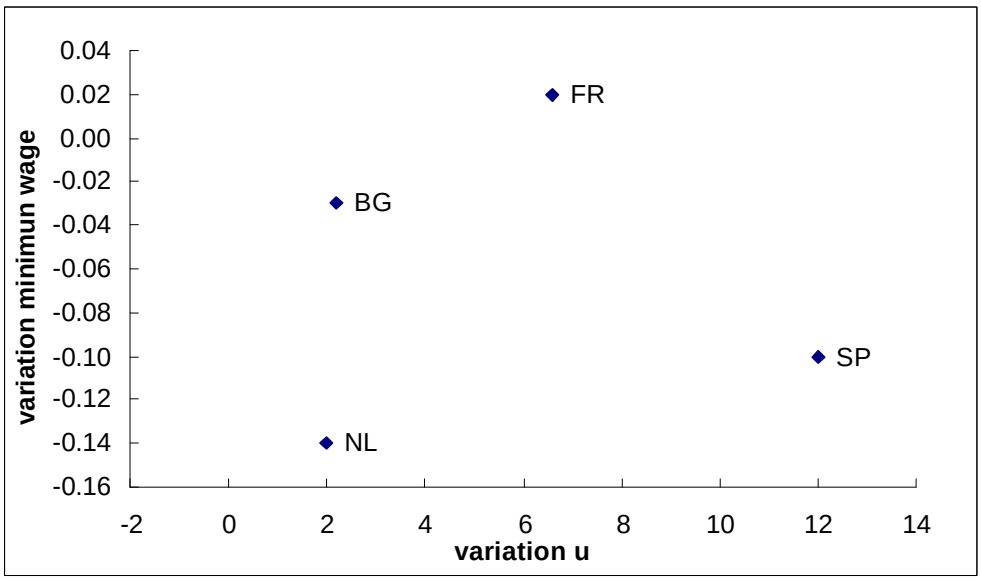

Source : OECD, Authors'calculations

BG = Belgium, SP = Spain, GE = Germany, FR= France, IE = Ireland, IT = Italy, NL = Netherlands, UK = United Kingdom

Table 2: Estimates with and without country slope dummies

		(2.1) Without Country Dummies		(2.2) With Country Dummies	
	Parameter	Estimate	*t-statistic*	Estimate	*t-statistic*
Labour Demand	constant	-0.4964	*-2.53*	-0.3171	*-2.19*
	ECM	-0.0949	*-2.62*	-0.0597	*-2.22*
	DLRW	-0.7960	*-12.18*	-0.7746	*-14.70*
	DLRW(-1)	0.5608	*4.27*	0.3675	*4.60*
	DLY	0.8500	*7.21*	0.5729	*9.54*
	DLY(-1)	-0.2420	*-1.73*	0.1054	*1.34*
	DLEE(-1)	0.6053	*5.20*	0.4412	*7.72*
	ESSI(-1)	-0.000066	*-0.66*	-0.000017	*-0.30*
	ESSI(-1)_GE			-0.004324	*-4.19*
	DLRW_GE			-0.3017	*-2.84*
	DLY_GE			0.4380	*6.00*
	DLEE(-1)_GE			-0.2463	*-4.14*
	DLRW(-1)_ES			-0.2776	*-3.10*
	DLRW_NL			0.4152	*3.02*
	DLRW_IT			0.6101	*3.96*
	UNITY	-0.0084	*-1.57*	0.0312	*3.00*
	GE	0.0020	*0.34*	0.3610	*4.19*
	ES	-0.0095	*-2.02*	0.0007	*0.19*
	NL	-0.0048	*-1.14*	-0.0060	*-1.91*
	IT	-0.0129	*-1.70*	-0.0213	*-4.35*
	UK	-0.0001	*-0.01*	0.0019	*0.36*
Wages	constant	-1.3294	*-5.49*	-2.4007	*-10.23*
	ECM	-0.2518	*-5.33*	-0.4373	*-9.33*
	U(-1)	-0.0031	*-4.06*	-0.0031	*-3.45*
	DLRCW(-1)	0.1730	*2.02*	0.1302	*2.04*
	DLYE	0.7164	*14.47*	0.7163	*16.36*
	DLYE(-1)	-0.2385	*-3.87*	-0.2871	*-6.26*
	MISM(-1)	0.0392	*2.80*	0.0614	*5.16*
	UND(-1)	0.0010	*3.29*	0.0031	*6.60*
	ESSI(-1)	0.000006	*0.06*	0.000066	*0.53*
	REP(-1)	0.0005	*0.93*	0.0014	*2.29*
	TAXWEDGE(-1)	0.0083	*0.28*	0.0303	*0.57*
	REP(-1)_DE			-0.0146	*-2.95*
	TAXWEDGE(-1)_DE			0.5538	*2.37*
	MISM(-1)_SP			0.6108	*5.85*
	UND(-1)_SP			-0.0033	*-4.73*
	REP(-1)_SP			-0.0046	*-3.12*
	UND(-1)_NL			0.0044	*3.00*
	REP(-1)_IT			-0.0034	*-4.35*
	MISM(-1)_UK			-0.1245	*-3.81*
	ESSI(-1)_UK			0.0034	*4.46*
	UNITY	-0.0102	*-1.24*	-0.0019	*-0.24*
	GE	-0.0304	*-2.90*	0.0179	*0.15*
	ES	0.0051	*0.49*	0.1484	*3.75*
	IT	-0.0597	*-2.48*	-0.1193	*-5.70*
	NL	-0.0339	*-3.07*	-0.1978	*-4.59*
	UK	-0.0095	*-0.61*	-0.1732	*-4.08*
	Sample size		112		112
	Diagnostics				
	Overidentying restrictions	CHISQ(12)	11.5	CHISQ(16)	15.2
Labour Demand					
	R2		0.832		0.937
	SSR		0.023		0.008
	SC	CHISQ(1)	0.584	CHISQ(1)	0.873
	HT	CHISQ(1)	0.171	CHISQ(1)	0.205
Wages					
	R2		0.613		0.752
	SSR		0.019		0.012
	SC	CHISQ(1)	0.068	CHISQ(1)	1.827
	HT	CHISQ(1)	0.089	CHISQ(1)	3.793

Notes : SSR is the sum of squared residuals.
SC is a serial correlation of order 1 test based on a significance of the lagged residuals in the model.
HT tests for heteroscedasticity by examining whether the squared residual exhibits a linear trend.
In both cases (*) means that the assumption of no serial correlation/or heteroscedasticity is rejected at the 5%, significance level.

Table 3: Estimates using different measure of employment protection

		(3.1) ESSI Measure		(3.2) WCR Measure		(3.3) Nicoletti et al Measure	
	Parameter	Estimate	*t-statistic*	Estimate	*t-statistic*	Estimate	*t-statistic*
Labour Demand	constant	-0.3171	*-2.19*	-0.3153	*-2.44*	-0.2453	*-1.61*
	ECM	-0.0597	*-2.22*	-0.0583	*-2.40*	-0.0444	*-1.61*
	DLRW	-0.7746	*-14.70*	-0.7881	*-14.42*	-0.7811	*-14.09*
	DLRW(-1)	0.3675	*4.60*	0.4284	*4.93*	0.4128	*4.69*
	DLY	0.5729	*9.54*	0.5969	*10.12*	0.6221	*10.00*
	DLY(-1)	0.1054	*1.34*	0.0467	*0.56*	0.0531	*0.60*
	DLEE(-1)	0.4412	*7.72*	0.4881	*8.16*	0.4850	*7.56*
	ESSI(-1)	-0.000017	*-0.30*	0.000029	*0.54*	0.000065	*0.35*
	ESSI(-1)_GE	-0.004324	*-4.19*	-0.000487	*-3.47*	0.000802	*2.94*
	DLRW_GE	-0.3017	*-2.84*	-0.3945	*-4.05*	-0.4330	*-4.49*
	DLY_GE	0.4380	*6.00*	0.4386	*5.28*	0.3635	*4.77*
	DLEE(-1)_GE	-0.2463	*-4.14*	-0.2315	*-4.02*	-0.2418	*-4.27*
	DLRW(-1)_ES	-0.2776	*-3.10*	-0.3165	*-3.24*	-0.2690	*-2.73*
	DLRW_NL	0.4152	*3.02*	0.4695	*3.33*	0.4514	*3.07*
	DLRW_IT	0.6101	*3.96*	0.6579	*4.27*	0.6257	*3.84*
	UNITY	0.0312	*3.00*	-0.0116	*-4.22*	-0.0026	*-0.62*
	GE	0.3610	*4.19*	0.0572	*3.45*	-0.0959	*-3.07*
	ES	0.0007	*0.19*	0.0000	*-0.01*	0.0005	*0.07*
	NL	-0.0060	*-1.91*	-0.0059	*-1.99*	-0.0071	*-2.14*
	IT	-0.0213	*-4.35*	-0.0219	*-5.19*	-0.0235	*-2.19*
	UK	0.0019	*0.36*	0.0046	*1.21*	0.0072	*0.49*
Wages	constant	-2.4007	*-10.23*	-2.1868	*-7.53*	-2.4009	*-9.19*
	ECM	-0.4373	*-9.33*	-0.4267	*-7.98*	-0.4513	*-9.21*
	U(-1)	-0.0031	*-3.45*	-0.0029	*-3.01*	-0.0033	*-3.48*
	DLRCW(-1)	0.1302	*2.04*	0.1851	*2.72*	0.1840	*2.85*
	DLYE	0.7163	*16.36*	0.7202	*16.22*	0.7924	*15.68*
	DLYE(-1)	-0.2871	*-6.26*	-0.3196	*-6.30*	-0.3049	*-6.26*
	MISM(-1)	0.0614	*5.16*	0.0453	*3.70*	0.0444	*3.83*
	UND(-1)	0.0031	*6.60*	0.0021	*3.80*	0.0020	*6.41*
	ESSI(-1)	0.000066	*0.53*	-0.000015	*-0.12*	0.001246	*3.49*
	REP(-1)	0.0014	*2.29*	0.0011	*1.46*	0.0004	*0.60*
	TAXWEDGE(-1)	0.0303	*0.57*	-0.0483	*-0.83*	-0.0497	*-1.13*
	REP(-1)_DE	-0.0146	*-2.95*	-0.0102	*-2.07*	-0.0106	*-2.20*
	TAXWEDGE(-1)_DE	0.5538	*2.37*	0.1994	*0.78*	0.0592	*0.28*
	MISM(-1)_SP	0.6108	*5.85*	0.5342	*5.21*	0.4532	*4.48*
	UND(-1)_SP	-0.0033	*-4.73*	-0.0018	*-1.83*	0.0000	*-0.03*
	REP(-1)_SP	-0.0046	*-3.12*	-0.0042	*-2.74*	-0.0034	*-2.31*
	UND(-1)_NL	0.0044	*3.00*	0.0042	*2.83*	0.0030	*2.26*
	REP(-1)_IT	-0.0034	*-4.35*	-0.0033	*-3.37*	-0.0017	*-2.00*
	MISM(-1)_UK	-0.1245	*-3.81*	0.0198	*0.76*	0.0227	*0.88*
	ESSI(-1)_UK	0.0034	*4.46*	-0.0001	*-0.42*	0.1291	*0.01*
	UNITY	-0.0019	*-0.24*	-0.0029	*-0.37*	0.0031	*0.44*
	GE	0.0179	*0.15*	0.1288	*0.98*	0.1877	*1.65*
	ES	0.1484	*3.75*	0.1077	*2.61*	0.0251	*0.56*
	IT	-0.1193	*-5.70*	-0.0929	*-2.94*	-0.1795	*-4.76*
	NL	-0.1978	*-4.59*	-0.1626	*-3.68*	-0.1293	*-3.29*
	UK	-0.1732	*-4.08*	-0.0232	*-0.82*	-2.0941	*-0.01*
	Sample size		112		112		112
	Diagnostics						
	Overidentying restrictions	CHISQ(16)	15.2	CHISQ(16)	16.5	CHISQ(16)	19.9
Labour Demand							
	R2		0.937		0.934		0.930
	SSR		0.008		0.009		0.009
	SC	CHISQ(1)	0.873	CHISQ(1)	1.260	CHISQ(1)	1.260
	HT	CHISQ(1)	0.205	CHISQ(1)	0.408	CHISQ(1)	0.180
Wages							
	R2		0.752		0.724		0.731
	SSR		0.012		0.014		0.014
	SC	CHISQ(1)	1.827	CHISQ(1)	0.313	CHISQ(1)	1.718
	HT	CHISQ(1)	3.793	CHISQ(1)	1.453	CHISQ(1)	1.228

Table 4: Estimates using different measure of the replacement rate and including the minimum wage

		(4.1) Rep100		(4.2) Rep67		(4.3) Min	
	Parameter	Estimate	*t-statistic*	Estimate	*t-statistic*	Estimate	*t-statistic*
Labour Demand	constant	-0.3141	*-2.16*	-0.3421	*-2.37*	-0.2978	*-2.00*
	ECM	-0.0592	*-2.18*	-0.0644	*-2.40*	-0.0559	*-2.01*
	DLRW	-0.7776	*-14.83*	-0.7714	*-14.67*	-0.7748	*-14.43*
	DLRW(-1)	0.3637	*4.61*	0.3824	*4.76*	0.3674	*4.57*
	DLY	0.5811	*9.58*	0.5688	*9.65*	0.6009	*10.09*
	DLY(-1)	0.1014	*1.29*	0.1129	*1.45*	0.0835	*1.04*
	DLEE(-1)	0.4428	*7.79*	0.4360	*7.69*	0.4476	*7.61*
	ESSI(-1)	-0.000021	*-0.37*	-0.000014	*-0.25*	-0.000013	*-0.22*
	ESSI(-1)_GE	-0.004219	*-4.13*	-0.004476	*-4.33*	-0.004278	*-4.11*
	DLRW_GE	-0.2948	*-2.74*	-0.3009	*-2.90*	-0.3177	*-2.95*
	DLY_GE	0.4349	*5.92*	0.4330	*6.08*	0.4126	*5.63*
	DLEE(-1)_GE	-0.2481	*-4.17*	-0.2473	*-4.41*	-0.2384	*-3.87*
	DLRW(-1)_ES	-0.2653	*-2.98*	-0.2955	*-3.27*	-0.2724	*-3.00*
	DLRW_NL	0.4305	*2.98*	0.3956	*3.01*	0.4127	*2.86*
	DLRW_IT	0.6020	*3.96*	0.6030	*3.85*	0.6153	*3.98*
	UNITY	0.0303	*2.92*	0.0328	*3.18*	0.0301	*2.83*
	GE	0.3519	*4.13*	0.3743	*4.32*	0.3583	*4.14*
	ES	0.0007	*0.19*	0.0004	*0.11*	0.0013	*0.32*
	NL	-0.0061	*-1.93*	-0.0057	*-1.85*	-0.0054	*-1.70*
	IT	-0.0210	*-4.28*	-0.0218	*-4.45*	-0.0211	*-4.25*
	UK	0.0016	*0.31*	0.0024	*0.46*	0.0024	*0.44*
Wages	constant	-2.4337	*-10.34*	-2.4093	*-10.15*	-2.5267	*-10.02*
	ECM	-0.4444	*-9.64*	-0.4358	*-9.15*	-0.4569	*-9.52*
	U(-1)	-0.0028	*-3.02*	-0.0034	*-3.80*	-0.0037	*-4.24*
	DLRCW(-1)	0.1428	*2.27*	0.1281	*1.95*	0.1308	*2.09*
	DLYE	0.7361	*16.24*	0.7165	*15.31*	0.7418	*16.29*
	DLYE(-1)	-0.2943	*-6.77*	-0.2658	*-5.62*	-0.2751	*-6.13*
	MISM(-1)	0.0693	*5.28*	0.0640	*4.36*	0.0570	*4.83*
	UND(-1)	0.0030	*6.91*	0.0030	*6.09*	0.0032	*7.05*
	ESSI(-1)	0.000075	*0.62*	0.000095	*0.73*	-0.000003	*-0.02*
	REP(-1)	0.0018	*2.80*	0.0010	*1.82*	0.0013	*1.92*
	TAXWEDGE(-1)	0.0192	*0.37*	0.0463	*0.87*	0.0316	*0.61*
	MIN(-1)					0.0596	*0.66*
	REP(-1)_DE	-0.0200	*-4.13*	-0.0067	*-2.03*	-0.0146	*-3.10*
	TAXWEDGE(-1)_DE	0.6814	*2.74*	0.3196	*1.72*	0.5672	*2.52*
	MISM(-1)_SP	0.5680	*5.48*	0.6188	*5.72*	0.5747	*5.51*
	UND(-1)_SP	-0.0030	*-4.65*	-0.0033	*-4.32*	-0.0025	*-2.31*
	REP(-1)_SP	-0.0058	*-3.53*	-0.0034	*-2.66*	-0.0033	*-1.97*
	UND(-1)_NL	0.0043	*2.88*	0.0046	*3.09*	0.0036	*1.75*
	REP(-1)_IT	-0.0041	*-4.83*	-0.0028	*-3.90*	-0.0034	*-4.31*
	MISM(-1)_UK	-0.1254	*-3.72*	-0.1275	*-3.67*	-0.1235	*-3.93*
	ESSI(-1)_UK	0.0033	*4.56*	0.0033	*4.19*	0.0035	*4.89*
	UNITY	0.0022	*0.28*	-0.0052	*-0.66*	0.0019	*0.24*
	GE	0.0803	*0.65*	-0.0602	*-0.49*	0.0375	*0.29*
	ES	0.1745	*4.03*	0.1199	*3.29*	0.1154	*2.75*
	IT	-0.1106	*-5.07*	-0.1295	*-6.20*	-0.0934	*-2.12*
	NL	-0.1964	*-4.57*	-0.2001	*-4.57*	-0.1781	*-2.84*
	UK	-0.1621	*-4.07*	-0.1721	*-3.78*	-0.1542	*-2.69*
	Sample size		112		112		112
	Diagnostics						
	Overidentying restrictions	CHISQ(16)	15.9	CHISQ(16)	14.8	CHISQ(16)	16.1
Labour Demand							
	R2		0.937		0.938		0.936
	SSR		0.008		0.008		0.008
	SC	CHISQ(1)	1.568	CHISQ(1)	1.791	CHISQ(1)	0.725
	HT	CHISQ(1)	0.221	CHISQ(1)	0.225	CHISQ(1)	0.186
Wages							
	R2		0.760		0.747		0.762
	SSR		0.012		0.012		0.012
	SC	CHISQ(1)	3.278	CHISQ(1)	0.716	CHISQ(1)	0.970
	HT	CHISQ(1)	7.147*	CHISQ(1)	2.142	CHISQ(1)	2.661

Table 5: Estimation with a larger sample of countries : Belgium, Germany, Spain, France, Italy, Ireland, the Netherlands, The United Kingdom

		(5.1) with a Larger Sample	
	Parameter	Estimate	*t-statistic*
Labour Demand	constant	-0.5153	*-3.90*
	ECM	-0.0957	*-3.95*
	DLRW	-0.4812	*-4.79*
	DLRW(-1)	0.1854	*3.18*
	DLY	0.5330	*9.73*
	DLY(-1)	0.0940	*1.36*
	DLEE(-1)	0.3606	*5.53*
	ESSI(-1)	0.000061	*0.93*
	ESSI(-1)_GE	-0.004139	*-2.88*
	DLRW_GE	-0.7123	*-3.90*
	DLRW(-1)_GE	0.5664	*5.50*
	DLY_GE	0.3804	*3.83*
	DLRW(-1)_ES	-0.4290	*-3.22*
	DLRW_NL	0.2872	*1.88*
	DLRW_IT	0.3472	*1.98*
	UNITY	0.0216	*1.48*
	DE	0.3487	*2.92*
	ES	-0.0039	*-0.96*
	NL	-0.0013	*-0.34*
	IT	-0.0224	*-4.40*
	GB	0.0084	*1.44*
	BG	0.0010	*0.51*
	IR	-0.0107	*-3.23*
Wages	constant	-2.9489	*-12.76*
	ECM	-0.4318	*-12.71*
	U(-1)	-0.0066	*-7.92*
	DLRCW(-1)	0.2166	*2.93*
	DLYE	0.6217	*11.96*
	DLYE(-1)	-0.2101	*-3.29*
	DLRW(-1)_UK	-0.3165	*-2.49*
	MISM(-1)	0.2743	*5.17*
	UND(-1)	0.0078	*7.94*
	ESSI(-1)	-0.000150	*-1.00*
	REP(-1)	0.0016	*2.95*
	TAXWEDGE(-1)	0.3725	*8.14*
	MISM(-1)_GE	-0.1785	*-3.24*
	UND(-1)_ES	-0.0070	*-7.01*
	MISM(-1)_IT	-0.1556	*-2.76*
	REP(-1)_IT	-0.0033	*-5.21*
	MISM(-1)_UK	-0.3934	*-6.58*
	UND(-1)_UK	-0.0058	*-4.61*
	ESSI(-1)_UK	0.0048	*5.54*
	UND(-1)_BG	-0.0176	*-6.05*
	ESSI(-1)_BG	0.0033	*5.62*
	TAXWEG(-1)_BG	-0.5668	*-10.70*
	UNITY	-0.0332	*-2.99*
	DE	-0.2059	*-7.08*
	ES	0.1767	*7.49*
	NL	-0.2636	*-8.14*
	IT	-0.2053	*-7.67*
	GB	-0.0768	*-1.29*
	BG	1.2072	*8.49*
	IR	-0.2590	*-7.06*
	Sample size		150
	Diagnostics		
	Overidentying restrictions	CHISQ(14)	15.8045
Labour Demand			
	R2		0.904
	SSR		0.015
	SC	CHISQ(1)	1.507
	HT	CHISQ(1)	1.617
Wages			
	R2		0.615
	SSR		0.027
	SC	CHISQ(1)	3.726
	HT	CHISQ(1)	0.678

Table 6 : Parsimonious model

		(6.1) Parsimonious Model	
	Parameter	Estimate	*t-statistic*
Labour Demand	constant	-0.4877	*-5.32*
	ECM	-0.0924	*-5.28*
	DLRW	-0.7670	*-15.11*
	DLRW(-1)	0.2404	*3.91*
	DLY	0.4862	*9.44*
	DLY(-1)	0.1690	*2.20*
	DLEE(-1)	0.3575	*6.92*
	DLRW_GE	-0.5587	*-7.01*
	DLY_GE	0.4305	*5.61*
	DLEE(-1)_GE	-0.2407	*-5.91*
	DLRW(-1)_ES	-0.2178	*-2.60*
	DLRW_NL	0.3587	*2.61*
	DLRW_IT	0.4881	*3.18*
	UNITY	-0.0086	*-2.69*
	GE	0.0034	*0.92*
	ES	-0.0025	*-0.89*
	NL	-0.0066	*-2.87*
	IT	-0.0221	*-5.96*
	UK	0.0044	*2.05*
Wages	constant	-1.7318	*-5.96*
	ECM	-0.3345	*-5.99*
	U(-1)	-0.0035	*-4.82*
	DLYE	0.1787	*2.36*
	DLYE(-1)	0.7767	*17.52*
	DLRCW(-1)	-0.2377	*-4.23*
	MISM(-1)	0.0282	*2.28*
	UND(-1)	0.0013	*4.14*
	MISM(-1)_SP	0.4142	*4.42*
	UND(-1)_NL	0.0032	*2.06*
	UNITY	-0.0012	*-0.21*
	GE	-0.0381	*-4.34*
	ES	-0.0243	*-2.79*
	IT	-0.0973	*-5.51*
	NL	-0.1205	*-2.67*
	UK	-0.0199	*-2.51*
	Sample size		112
	Diagnostics		
	Overidentying restrictions	CHISQ(17)	20.6
Labour Demand			
	R2		0.934
	SSR		0.009
	SC	CHISQ(1)	2.591
	HT	CHISQ(1)	0.548
Wages			
	R2		0.649
	SSR		0.017
	SC	CHISQ(1)	0.329
	HT	CHISQ(1)	0.140

Table 7: Contribution of institutions in changes of the structural unemployment in selected EU countries

1979-97

	Mismatch		Union Density		Terms of Trade
	Impact	*Std. Error*	Impact	*Std. Error*	Impact
Germany	1.4	*0.6*	-3.3	*-0.8*	-0.7
Spain	-1.2	*-0.4*	3.9	*0.9*	3.4
France	0.1	*0.1*	-4.1	*-1.0*	2.7
Italy	2.1	*0.9*	-3.6	*-0.9*	-3.6
Netherlands	-0.1	*0.0*	-11.1	*-3.4*	6.6
UK	-0.4	*-0.2*	-7.8	*-1.9*	-1.3

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