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WORKING PAPER

Differences in hours worked in the OECD: institutions or fiscal policies? *

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July 2009

2009/601

* Paper presented at the 24th Annual Congress of the European Economic Association, Barcelona, August 2009.

We are grateful to Stijn Baert, Tine Dhont and Gerdie Everaert for valuable suggestions and comments on an earlier draft of this paper, and to Tine Dhont for her contribution to the construction of the dataset. We also wish to acknowledge support from the Belgian Program on Interuniversity Poles of Attraction, initiated by the Belgian State, Federal Office for scientific, technical and cultural affairs, contract UAP No. P 6/07. Any remaining errors are ours.
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D/2009/7012/53

Differences in hours worked in the OECD: institutions or fiscal policies?

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Abstract

This paper studies the determinants of the level and the evolution of per capita hours worked in a panel of OECD countries since the 1970s. Following Pesaran (*Econometrica*, 2006), our empirical strategy allows for the possibility of cross-sectionally correlated error terms due to unobserved common factors which are potentially non-stationary. We find that much of the variation in hours worked across countries and over time can be explained by differences in fiscal policy, i.e. differences in the level and structure of taxes and in the structure of government expenditures. Hours worked rise when labour taxes and non-employment benefits fall and when the shares of productive government expenditures and government wage consumption increase. Differences in (the evolution of) labour and product market institutions have much less of a role to play. Our results show that a careful treatment of the time-series properties of the data is crucial.

Key words: hours worked, taxes, government expenditures, labour market institutions, panel data

JEL: C33, E24, E62, H20

1. Introduction

Hours worked vary widely across OECD countries. Americans are known to work more than Europeans. Some Europeans are known to work more than others. Moreover, not only the level of hours worked, but also their evolution during the last decades has been very different across countries. Table 1 and Figure 1 document the facts. Table 1 shows differences in the level of the employment rate in hours in 2000-2005. Employment rates range from a little more than 50% in Belgium, France and Italy to more than 68% in the US, Switzerland and Japan. Figure 1 depicts the evolution since 1970 in four fairly homogenous country groups. In 1970 differences across these country groups were relatively small. In each of the four groups the employment rate in hours was between 65% and 71% on average. Differences have become substantial however in more recent periods. The average employment rate in six core countries of the euro area fell from 66% in 1970 to 53% in 2005. In five Anglo-Saxon countries the employment rate was still at 66% on average in 2005, just like in 1970, although it had fallen to significantly lower levels in the early 1980s. The Nordic country group shows a gradual fall in the employment rate from about 70% on average in 1970 to about 61% in 2005. This leaves the Nordic group closer to the US than to the core euro area average.

The reasons for these differences across countries and over time have been the subject of intense discussion in recent economic literature. Two broad views seem to have emerged. A first group of studies emphasize the key role of differences in labour and product market characteristics and rigidities (e.g. Blanchard and Wolfers, 2000; Nicoletti and Scarpetta, 2005; Alesina et al., 2005; Nickell et al., 2005). A second group of studies put fiscal policy differences at the centre of the explanation, i.e. differences in the level and structure of taxes and government expenditures. Many of the studies in this second group pay no attention to labour or product market rigidities (Prescott, 2004; Rogerson, 2007; Ohanian et al., 2008; Dhont and Heylen, 2008, 2009). Others (e.g. Daveri and Tabellini, 2000) emphasize that the effects of tax changes may depend on labour market institutions. Our aim in this paper is to test the explanatory power of both views econometrically in a panel of OECD countries in 1970-2005. To the best of our knowledge, the second view has hardly been tested econometrically. Moreover, earlier econometric panel studies have typically investigated either unemployment or the employment rate in persons. Faggio and Nickell (2007) and Causa (2008) are exceptions. Both have (also) studied the determinants of hours worked per employed person. Our focus is on average hours worked per person of working age. This is clearly the most comprehensive measure of labour input. It rises in both the number of employed and the hours worked per employed. Our main results are robust, however, when we use the employment rate in persons. Our empirical strategy is based on Pesaran (2006). It allows for the possibility of cross-sectionally correlated error terms due to unobserved common factors which are potentially non-stationary.

The structure of this paper is as follows. In Section 2 we briefly set out the main hypotheses put forward in the literature to explain employment differences across OECD countries. Section 3 briefly describes our data. In Section 4 we explain our empirical strategy, whereas Section 5 presents the results. In Section 6 we conclude and summarize our main findings. Our results support the fiscal view. Differences in labour taxes and in the structure of government expenditures explain much of the variation in hours worked both across countries and over time, at least since the 1980s. We find that hours worked fall when the labour tax rate and the unemployment benefit replacement rate are increased, and when the shares of productive government expenditures and government wage consumption are reduced. Furthermore, we observe that

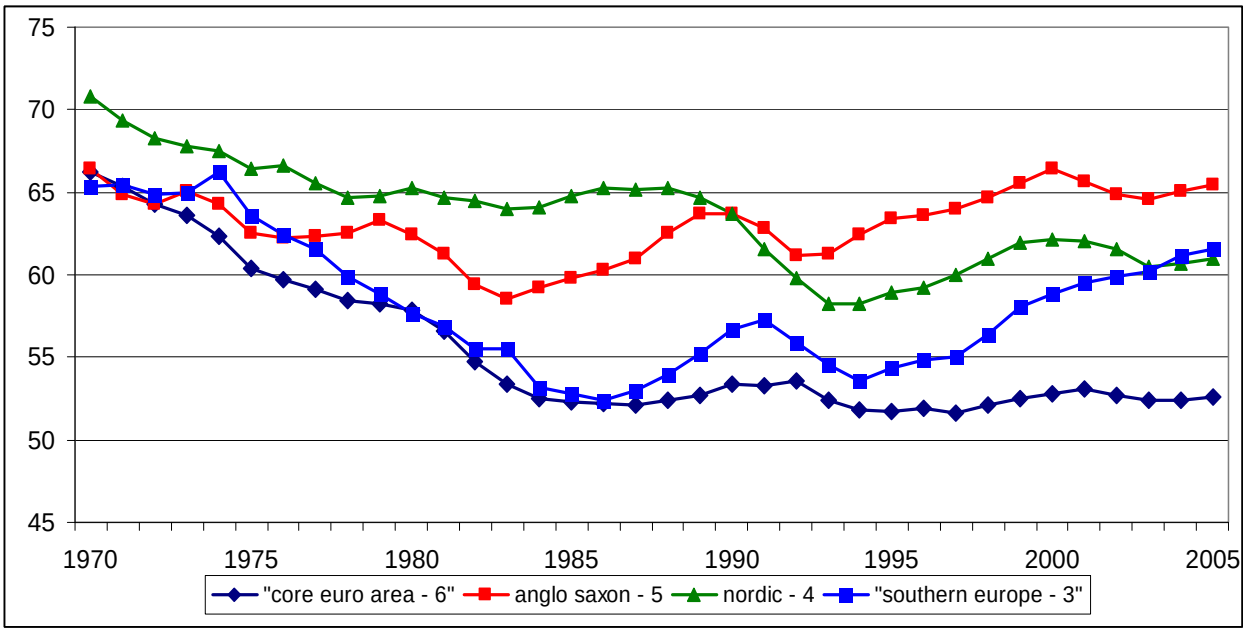
the size of the negative labour tax effect depends on the composition of government expenditures. For example, tax effects are smaller when the share of productive expenditures is higher. By contrast, differences in labour or product market institutions cannot explain the variation in hours worked. If there is a role for institutions, the only conclusion we may draw from our results is that labour tax effects are less negative in coordinated wage bargaining regimes. Methodologically, our results underscore the need for a careful treatment of the time-series properties of the data. We observe that the standard fixed effects panel data estimator, which is commonly used in empirical labour studies, may yield spurious results. By contrast, many of the results that we obtain using Pesaran's (2006) Common Correlated Effects Pooled estimator survive standard diagnostic tests.

Table 1. Employment rate in hours[a], in %, 2000-2005

Lower than 56%		Between 56% and 65%		Higher than 65%	
Belgium	51.2	Spain	56.4	Australia	65.7
Italy	51.2	Norway	58.1	Portugal	65.7
France	51.5	Greece	58.5	Ireland	65.9
Germany	53.4	United Kingdom	60.3	Canada	66.4
Austria	53.7	Finland	60.8	United States	68.3
Netherlands	55.4	Denmark	62.9	Switzerland	68.5
		Sweden	63.4	Japan	69.7

(a) The employment rate in hours indicates the fraction of 'potential' hours that is actually being worked in an economy. It is calculated as total hours worked divided by 1920 times population at working age (15 to 64). We assume that a full time worker potentially supplies 1920 hours per year (40 hours per week times 48 weeks).
Source: Total hours worked : The Conference Board and Groningen Growth and Development Centre, Total Economy Database, January 2008
Population at working age : OECD Stat, Annual Labour Force Statistics.

Figure 1. Employment rate in hours in four country groups, %, 1970-2005.



Note: Core euro area : Austria, Belgium, France, Germany, Italy, Netherlands; Anglo-Saxon : Australia, Canada, Ireland, UK, US; Nordic : Denmark, Finland, Norway, Sweden; Southern Europe : Greece, Portugal, Spain. Data for individual countries, also including Japan and Switzerland, are reported in Appendix 1.
Sources: see Table 1.

2. Institutions, fiscal policy and employment: theoretical foundations

Research on (un)employment differences across OECD countries has grown rapidly during the last two decades. Most studies have emphasized the key role of labour market and product market institutions. Prominent labour market institutions are unionization and the structure of collective bargaining, employment protection legislation and the unemployment benefit system (see Section 2.1). Most studies also include the level of labour taxes, as an important fiscal policy variable. In recent years, a growing number of studies have shifted the emphasis from institutions to the role of fiscal policy, i.e. tax levels, government spending levels and their composition (Section 2.2.). A few studies have highlighted the interaction between institutions and fiscal policy changes (Section 2.3.).

2.1. Labour and product market institutions and employment

Strong *trade unions* have generally been seen as a potential cause of lower employment due to their capacity to monopolize labour supply and to push wages above market-clearing levels (see e.g. Oswald, 1985, for a survey)[1]. Early influential work on explaining cross country employment differences in the OECD has emphasized however that the influence of unions on wage formation and employment depends crucially on the *structure of collective bargaining* (Bruno and Sachs, 1985; Calmfors and Driffill, 1988). Employment would be higher in either a regime with weak unions and decentralized wage bargaining or a regime with strong unions and highly coordinated/centralized wage bargaining. The main reason for the latter is that coordinated wage bargaining induces unions to internalize the detrimental effects from excessive wages. Reality would thus seem to be described best by a 'U-shaped' relationship between the degree of bargaining coordination/centralization and employment, rather than by a monotonically negative relationship between union power and employment. Although certain studies have found support for this 'U-shaped' pattern (e.g. Calmfors and Driffill, 1988; Elmeskov et al., 1998), the empirical evidence seems to remain inconclusive after all (Bassanini and Duval, 2006). Estimated effects of union density variables on employment also show up highly ambiguous, negative in some studies, insignificant or even positive in others (see the survey of empirical studies in Bassanini and Duval, 2006).

Theoretical effects of *employment protection legislation* (EPL) on aggregate employment are ambiguous (Young, 2003; OECD, 2004). First, EPL introduces restrictions on the ability of firms to adjust the workforce, and raises the cost of firing workers. Furthermore, since EPL increases employee protection against dismissal, workers have higher bargaining power and may claim higher wages. Due to higher costs firms may cut hirings (and firings) and reduce employment. On the other hand, reduced labour market turnover will imply longer unemployment spells and make the incidence of unemployment more costly. This may encourage workers to moderate wage claims, which is positive for employment. Econometric studies on the employment impact of EPL do not help to get rid of this theoretical ambiguity. Most studies find that the incidence of long-term unemployment rises, but the effects on aggregate (un)employment are not clear. Some studies find higher aggregate unemployment or lower employment when EPL is extended (e.g. Nicoletti and Scarpetta, 2005), others find the opposite or insignificant results

[1] Alesina et al. (2005) have recently developed an alternative hypothesis according to which strong unions may raise workers' taste for leisure, and consequently reduce labour supply. Union involvement (coordination) may e.g. facilitate members of the same family to have vacation at the same time, which raises their marginal utility of leisure.

(e.g. Nickell et al., 2005; Bassanini and Duval, 2006). At best, it seems possible to detect robust effects of EPL on the employment rate of specific groups, e.g. a robust negative effect on youth employment (OECD, 2004).

High unemployment benefits and long benefit duration are generally predicted to reduce employment. They may reduce the incentive for workers to go out and search, as well as the willingness of unemployed workers to accept job offers. Effective labour supply falls. To the extent that they raise worker utility in the case of unemployment, high and long lasting benefits may also put upward pressure on wage claims, and reduce labour demand. On the other hand, unemployment benefits allow workers to search longer and better, which may promote the quality of job matches, aggregate efficiency and therefore employment. Although there are some exceptions, most empirical studies find significant adverse effects of benefit generosity on (un)employment (e.g. Nickell et al., 2005; Nicoletti and Scarpetta, 2005; Bassanini and Duval, 2006).

The influence of *product market regulation* on labour market performance has received growing attention in recent literature. Product market deregulation and flexibility are expected to raise employment. They promote the entry of new firms and reduce market power of incumbent firms and their workers. Although wage claims at the firm level may fall, real wages may rise due to lower aggregate prices. Firm entry, lower prices and higher real wages contribute to the expansion of activity, labour supply and employment (Blanchard and Giavazzi, 2003). Empirical research generally supports the hypothesis that product market deregulation and flexibility promote employment (e.g. Nicoletti and Scarpetta, 2005; Bassanini and Duval, 2006).

In addition to the above mentioned variables, empirical studies in the institutional tradition will typically also include *labour taxes* and – although much less frequently – *government spending on active labour market policies*. Since these variables relate to fiscal policy, we discuss their influence in the next section.

2.2. Taxes, government spending and employment

A growing number of researchers have recently developed and calibrated theoretical models that explain employment variation across countries and over time from differences in fiscal policy, i.e. differences in the level and the composition of taxes and government expenditures (e.g. Turnovsky, 2000; Prescott, 2004; Rogerson, 2007; Ohanian et al., 2008; Dhont and Heylen, 2008, 2009). In general these models assume perfect competition. Cross-country differences in labour market rigidity are considered not to be critical.

Turnovsky (2000) and Dhont and Heylen (2009) set up the broadest models, which also endogenize growth in a general equilibrium framework. Their models generate a ranking of different taxes and different government expenditures according to their effects on employment. Taxes on labour exert the most negative effect on employment. Higher labour taxes diminish the marginal utility gain from working compared to leisure or non-market activities. Individuals will cut labour supply, which reduces employment. A reduction of employment subsequently brings down the marginal productivity of physical capital, which undermines investment and growth. Lower investment eventually causes an additional drop in employment due to the negative effects of a decline in physical capital on labour productivity, wages and labour supply.

Higher consumption taxes also make workers cut labour supply and employment, but its effects are smaller. Compared to labour taxes, a key difference is that higher consumption taxes also affect the utility gain from being non-employed and receiving benefits. Capital taxes have the smallest influence on employment. They do not directly affect workers' labour-leisure choice.

They mainly operate through their negative effects on physical capital formation and labour productivity, which indirectly affect employment.

Next to the composition of taxes, Rogerson (2007) and Dhont and Heylen (2008, 2009) emphasize the key role of the allocation of tax revenues. A different composition of government expenditures implies very different employment effects. Raising taxes to finance benefits related to non-employment generates the strongest drop in employment. Workers are then twice discouraged to work. Employment effects of raising taxes are very negative also when tax revenues are used to finance lump sum transfers or useful government consumption. The reason is that these expenditures eliminate the usual negative income effect from higher taxes which makes individuals work more (and which partly counteracts the substitution effect). Negative employment effects of higher labour taxes are small or even non-existent if tax revenues are used to finance productive expenditures. Rogerson (2007) emphasizes the positive effects of child care subsidies (which cut the cost of working). Dhont and Heylen (2009) show positive effects of education, active labour market policies and public infrastructure investment. A key argument is that these expenditures raise labour productivity and therefore wages and the return to working. There is an obvious direct effect when education and active labour market expenditures improve human capital, and when better infrastructure improves the effectiveness of human capital. In line with earlier arguments, there are also indirect effects when productive expenditures raise the productivity of physical capital and investment and growth.

Additional simulations with the model developed by Dhont and Heylen (2009) reveal that tax effects on employment may also depend on the historical composition of government expenditures. For example, tax effects are smaller when the share of productive expenditures is higher and the share of non-employment benefits is lower. A higher share of productive expenditures implies that employment will be higher, and labour supply steeper. The response of employment to tax changes will then be more moderate. A higher share of non-employment benefits implies the opposite.

Empirically, Prescott (2004) claims that labour and consumption tax differences explain the whole gap in hours worked that has grown between the US and the biggest European countries since the early 1970s. To get this result Prescott imposes a high labour supply elasticity and assumes that tax revenues are used to finance lump sum transfers. Various authors have criticized Prescott's approach. Ljungqvist and Sargent (2006) point out that Prescott's model fails as soon as realistic differences in non-employment benefits between Europe and the US are taken into account. Rogerson (2007) and Dhont and Heylen (2008, 2009) point out that Prescott is unable to explain relatively high employment in the Nordic countries. To account for this, Rogerson introduces employment subsidies (child care subsidies). Dhont and Heylen introduce productive expenditures. They claim that a rich, perfectly competitive optimizing model with different tax rates and different kinds of expenditures is able to account for the main differences in hours worked, not just between Europe and the US, but also within Europe.

2.3. Labour market institutions and the employment effects of taxes

Blanchard and Wolfers (2000) have argued that it is not (good or bad) institutions as such that account for differences in labour market performance across OECD countries, but the interaction of institutions and aggregate shocks. A number of authors have made a similar argument for the effect of tax changes. Building on Calmfors and Driffill (1988), it has been shown by Daveri and Tabellini (2000) and Berger and Everaert (2007) that the (un)employment effects of labour taxes

are smaller (or even non-existent) in highly decentralized and highly centralized/coordinated wage bargaining regimes. The US and the UK represent the first regime, the Nordic countries are often taken as examples of the second regime. The largest tax incidence on (un)employment is observed in countries like France, Italy and Belgium where collective bargaining institutions are neither centralized/coordinated nor decentralized.

Next to the degree of centralization/coordination of collective bargaining, wage bargaining models suggest other 'institutions' that may change the effect of taxes on employment. Standard examples are the tax treatment of alternative income sources like unemployment benefits, and the degree of product market competition (see Berger and Everaert, 2007, for a more extensive discussion). More recently, Doménech and Garcia (2008) have argued that the effect of taxes on (un)employment may differ as a function of the efficiency with which the government transforms taxes into public goods or transfers.

This section and the previous provide ample reasons for why there may not be a clear-cut relation between labour taxes and employment. The existing empirical literature also demonstrates a lack of robustness. The estimated elasticity of aggregate (un)employment with respect to taxes ranges from zero (Nickell, 1997; Layard et al., 2005; Blanchard and Wolfers, 2000) over medium-sized (Elmeskov et al., 1998; Nickell et al., 2005; Bassanini and Duval, 2006; Planas et al., 2007; Faggio and Nickell, 2007) up to large (Daveri and Tabellini, 2000). Investigating hours worked per employed, Causa (2008) also finds ambiguous tax effects[2]. One of our aims in this paper is to provide more precise estimates, by explicitly accounting for both the potential influence of the composition of government expenditures and the role of specific labour market institutions like the degree of coordination of collective bargaining. Furthermore, we may deal with some remaining problems of econometric methodology (see Section 4).

3. Data

Our dataset consists of yearly observations for 20 OECD countries in 1970-2005. Table 1 shows these countries. Appendix 2 contains a detailed description of the data and their sources. It also indicates missing observations for some countries and/or periods. In particular, most labour market institutional data are available only until 2003.

Our main dependent variable is the employment rate in hours which we have introduced in Section 1. Key explanatory variables, which are important in both the labour market institutional view and the fiscal policy view, are the tax rate on labour income, the consumption tax rate and the gross unemployment benefit replacement rate. As a measure of labour taxes we use the implicit tax rate on employed labour from Martinez-Mongay (2000). This tax rate has been calculated with the so-called Mendoza-Razin-Tezar approach (see Mendoza et al., 1994). It is defined as the ratio of labour tax revenue, including social contributions, to the taxable base. Tax indicators based on this approach have been used in many empirical studies (e.g. Planas et al., 2007; Berger and Everaert, 2007; Daveri and Tabellini, 2000; Ohanian et al., 2008). The gross benefit replacement rate that we use is the overall average rate over three family situations, three unemployment durations and two earnings levels before unemployment, as computed by the OECD. Additional explanatory variables capturing labour market institutions are the union density rate, an index for the strictness of employment protection legislation and an index rising in the degree of coordination of wage bargaining. The former two variables have been taken from

[2] She finds more robust results when she studies the (heterogeneous) behaviour of specific sub-groups composing the labour force. Although very useful, disaggregation goes beyond the focus of this paper.

the OECD (see also Bassanini and Duval, 2006), the latter has been constructed from detailed national and international sources by Kenworthy (2001). To assess the influence of product market regulation we introduce the OECD summary indicator of regulatory impediments to product market competition in seven non-manufacturing industries (see Conway et al., 2006).

A number of variables capture the influence of fiscal policy. In addition to labour taxes and consumption taxes we introduce a capital tax rate as a third variable from the revenue side. The results that we will present include the statutory corporate income tax rate. Alternatively, we have introduced an implicit capital income tax rate in line with Martinez-Mongay (2000, see our Appendix 2). Our results do not depend on the specific capital income tax rate that we use. In addition to unemployment benefits (replacement rate), we include as spending variables the share of productive government spending and the share of government consumption (excluding education related consumption) in percent of GDP. We split up the latter in a wage component and a non-wage component. Additional variables that we define to capture the effects of the composition of government spending are productive spending, wage and non-wage consumption spending and social expenditures in percent of total expenditures. As a final variable in all our regressions we include the output gap to capture business cycle effects.

4. Econometric Methodology

This section outlines the estimation methodology developed by Pesaran (2006) and Kapetanios et al. (2006) that we use in our regression analysis. Unlike standard fixed effects panel data estimators, this methodology can account for cross-sectional dependence in the error terms due to unobserved common factors which are potentially non-stationary.

4.1. Unobserved common factors in labour market indicators

Macroeconomic aggregates of different countries are likely to be (partly) explained by common factors such as global shocks or common business cycle factors. Regarding labour markets Smith and Zoega (2008) have recently shown that there is a common factor that drives unemployment rates in 21 OECD countries. In their study this unobserved common factor explains about 70% of the total variance in the unemployment rates. In a standard fixed effects panel data model the presence of unobserved common factors will result in cross-sectionally correlated error terms. If these common factors are uncorrelated with the explanatory variables included in the regression, the within estimator is still unbiased but not efficient. The standard approach to overcome the biased standard errors is to estimate the cross-sectional units as seemingly unrelated regressions (SUR) and use a GLS transformation to estimate the panel. However, this approach is only possible when the time dimension is sufficiently larger than the cross-section dimension. If the omitted common factors are correlated with the explanatory variables, not only inference is misleading but also the estimated parameters are biased. Even worse, when the unobserved common factors are non-stationary, both the within estimator and the SUR-GLS estimator yield spurious results.

The issue of cross-sectional error dependence has received much attention in the recent panel data literature and a growing number of studies propose a factor structure of the error component (see e.g. Pesaran, 2006; Bai and Ng, 2002; Phillips and Sul, 2003). Here we follow this line of research and allow for unobserved common factors in the error terms. To be more specific consider the following panel data model:

$$y_{it} = \alpha_i + \beta' x_{it} + \varepsilon_{it} \qquad i = 1,...,N; \qquad t = 1,...,T, \tag{1}$$

$$\varepsilon_{it} = \omega_i \phi_t + \gamma_i' \bar{z}_t + \upsilon_{it}, \qquad \upsilon_{it} \sim iid \quad \mathcal{N}(0, \sigma^2) \tag{2}$$

where α_i are the cross-section specific fixed effects and $x_{it} = (x_{1,it},...,x_{k,it})'$ is a $k \times 1$ vector of explanatory variables. β is a vector of parameters. The distinctive feature of this model is that it allows for (i) a time trend with a country specific impact $\omega_i \phi_t$ and (ii) unobserved common factors $\gamma_i' \bar{z}_t$ which are also allowed to have country specific effects. Following Pesaran (2006) we proxy the unobserved common factors by the cross-section averages of the dependent and the explanatory variables, i.e. $\bar{z}_t = \frac{1}{N}\sum_{i=1}^{N} z_{it}$ and $z_{it} = (y_{it}, x_{it})'$. The model given by (1) and (2) can be seen as a generalisation of the fixed effects estimator that allows for cross-sectional dependence in the error term due to unobserved common factors. The estimator, referred to as Common Correlated Effects Pooled (CCEP) estimator, can be computed by applying least squares technique. Asymptotically, as *N* goes to infinity, the cross-sectional averages will eliminate the differential effect of the unobserved common factors. Extensive Monte Carlo experiments in Pesaran (2006) show that the small sample properties of the CCEP estimator are satisfactory. The conventional method to deal with cross-sectional error term correlation is to assume a common time effect. In order to investigate the importance of accounting for unobserved common factors we will compare the results of the CCEP estimator to a standard fixed effects estimator, i.e. equation (2) with year dummies instead of $\gamma_i' \bar{z}_t$.

4.2. Time series properties

In this section we take a look at the time series properties of our data. We first check for non-stationarity using panel unit root tests. We test for unit roots using the Maddala and Wu (1999) (MW) panel unit root tests. The latter combines the p-values, denoted p_i, from the country-specific Augmented Dickey-Fuller (ADF) unit root tests as

$$P_{MW} = -2\sum_{i=1}^{N} \log p_i, \qquad i = 1,...,N. \tag{3}$$

P_{MW} has a χ^2_{2N} distribution if the underlying country-specific tests are independent. As many of our variables are highly correlated over countries, this assumption is clearly not satisfied. Therefore, we simulate the distribution of P_{MW} using a bootstrap procedure (see Berger and Everaert, 2008, for details). Table 2 presents the test results. Most of the variables considered here are found to be non-stationary. Although the non-stationarity of labour market variables and thus the possibility of a spurious regressions problem are acknowledged in the literature, most studies ignore this issue. Noteworthy exceptions are Berger and Everaert (2007) and Planas et al. (2007) who estimate the labour tax unemployment trade-off. Both studies disentangle the rate of unemployment into a stationary and a non-stationary part using the Kalman filter and maximum likelihood technique.

Table 2. Panel unit root tests

	MW – ADF test statistic	*p*-value
Employment rate in hours	15.7	0.999
Labour tax rate	48.6	0.165
Benefit replacement rate	19.2	0.998
Consumption tax rate	47.2	0.208
Capital tax rate	24.0	0.978
Productive government spending in percent of GDP	46.7	0.215
Government wage consumption spending in percent of GDP	28.4	0.872
Government non-wage consumption spending in percent of GDP	26.9	0.912
Union density rate	59.2	0.026
Employment protection legislation	47.1	0.204
Product market regulation	5.58	1.000
Wage bargaining coordination	10.9	1.000

4.3. Consistency of the CCEP estimator

If there are unobserved non-stationary factors which are not accounted for they will become part of the error term, thus leading to spurious results. As our dependent variable and most of the explanatory variables are non-stationary, the possibility of non-stationary unobserved factors should be considered. Moreover, the common factor that drives OECD unemployment rates in Smith and Zoega (2008) is found to be non-stationary. If one believes that there is a non-stationary common factor explaining unemployment across countries, then, at least, the possibility of non-stationary common factors should not be ruled out a priori if the rate of employment is the dependent variable. Regarding the CCEP estimator, Kapetanios et al. (2006) consider the important case of non-stationary panels. They prove that the CCEP estimator is consistent even when the observed and unobservable factors are integrated. Intuitively this can be explained by the use of cross-sectional means as additional regressors, which will capture the non-stationarity and yield stationary residuals. Although the CCEP estimator does not require any knowledge on the integration or cointegration properties of the unobserved factors or observed data, it is required that the number of unobserved factors remains fixed as the sample size increases. Moreover, the Monte Carlo study in Kapetanios et al. (2006) is based on the assumption of unobserved common factors which are integrated of order one. Therefore we will check whether the residuals are stationary using the panel unit-root test procedure outlined above. The only difference is that we need to take into account that the estimated residuals cannot be treated as 'raw' data as they are obtained from minimising the sum of their squares. We check for cointegration using country specific EG tests, i.e. ADF tests on the country specific residuals, and combine these EG tests in a MW-EG panel cointegration test using equation (3). The test statistic and the distribution of this test are again simulated using a bootstrap procedure (see Berger and Everaert, 2008, for technical details).

5. Results

Tables 3 and 4 contain our main results. Table 3 tests the labour and product market institutions view. Next to the CCEP estimator in columns (5) and (6), we also use the more frequent fixed effects estimator in columns (1) to (4). All fixed effects regressions also include a country specific time trend and time dummies. Columns (1) and (2) use data for 1982-2003, which makes the setup in these regressions highly comparable to the approach taken by Bassanini and Duval (2006). Our results broadly confirm theirs, as well as most of the literature surveyed in Section 2.1. We find significant negative effects from labour taxes, unemployment benefits, union density and product market regulation. Furthermore, our results confirm the existence of a U-shaped relationship between the degree of wage bargaining coordination and employment. This U-shape also occurs in column (2) for labour tax rates below 52%, a condition which all countries fulfil. Finally, we obtain a significant positive effect for the output gap. The effects of employment protection legislation and the consumption tax rate are insignificant. In columns (3) and (4) we extend the estimation period to 1970-2003. Our results seem to be robust only for the labour tax rate, union density, product market regulation and the output gap. We now obtain a significant positive effect for employment protection legislation. A U-shaped relationship between wage bargaining coordination and employment only shows up in column (4) for tax rates below 25%, a condition which only a minority of countries fulfil. In addition to limited robustness, the fixed effects results suffer from two major other problems. First, since the fixed effects estimator does not control for cross-sectional correlation in the error terms, whereas employment is highly correlated across countries, estimation may suffer from the potential problems described in Section 4.1. Second, the fixed effects results are spurious. As shown at the bottom of Table 3, we can never reject the null hypothesis of no cointegration. Columns (5) and (6) present CCEP estimation results. Except for the output gap, the benefit replacement rate and union density, all variables lose statistical significance in column (6). Moreover, the results are again spurious. All in all, the labour market institutions view seems unable to capture the permanent movements in the employment rate in hours.

Table 4 tests the fiscal policy view. We only report CCEP estimates. When we use the fixed effects estimator, our results are again spurious. The first column includes in a linear way all fiscal policy variables shown to be important in recent theoretical models with endogenous employment and growth (e.g. Turnovsky, 2000; Dhont and Heylen, 2009). The only difference is that we have further split up government consumption, excluding public education, in a wage and a non-wage component. Since in our specification we do not control for transfers (other than unemployment benefits) and the government budget balance, estimated parameters show the effect of a change in one of the included fiscal variables financed by a change in these transfers or by borrowing . The estimation results in column (1) are rather weak. We do get cointegration, but the Baltagi-test rejects the null of no autocorrelation. We therefore allow for an AR(1) process in the residuals (see the CCEP AR estimates). Moreover, some variables like the capital tax rate and the share of productive government spending in GDP seem to get the wrong sign. Labour and consumption tax rates obtain the correct negative sign, but they are insignificant. In column (2) we extend the set of explanatory variables by a number of interaction terms. We interact the labour tax rate with four expenditure variables as a share of total expenditures: social benefit expenditures, productive spending, wage consumption and non-wage consumption. By including these, we test the hypothesis that changes in labour taxes affect employment differently depending on a country's composition of government expenditures. As we explained in Section

2.2., theoretical tax effects may be smaller when the share of productive expenditures is higher and the share of benefits is lower. The results in column (2) are much better. We obtain cointegration. Moreover, the hypothesis of no autocorrelation can no longer be rejected. The effects of labour and consumption tax rates are now significantly negative. So is the effect of the benefit replacement rate. Our results confirm that the employment effect of labour taxes differs according to the composition of expenditures. The effect is significantly less negative when a higher fraction of expenditures is productive or related to wage consumption.

Table 3. Regression results for the employment rate in hours: the institutions view

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	Fixed effects (a)	Fixed effects (a)	Fixed effects (a)	Fixed effects (a)	CCEP (b)	CCEP (b)
Estimation period	1982-2003	1982-2003	1970-2003	1970-2003	1970-2003	1970-2003
Labour tax rate	-0.19 **	-0.08 **	-0.46 **	-0.96 **	-0.01	0.07
Benefit replacement rate	-0.08 **	-0.07 **	-0.02	-0.01	-0.06 *	-0.06 *
Consumption tax rate	0.09	0.07	-0.08	-0.08	0.06	0.09
Union density rate	-0.19 **	-0.18 **	-0.07 *	-0.10 **	-0.25 **	-0.21 **
Employment protection legislation	-0.17	-0.15	1.99 **	2.11 **	-1.06 **	-0.70
Product market regulation	-0.70 **	-0.78 **	-1.69 *	-1.86 **	0.21	0.34
Wage bargaining coordination	-1.45	-3.72	0.02	-9.98 **	-2.28	2.39
Wage bargaining coordination squared	0.63 **	1.56 **	0.32 *	2.05 **	1.01 **	0.01
Output gap	0.46 **	0.46 **	0.40 **	0.38 **	0.45 **	0.42 **
Interaction terms						
Labour tax rate x wage bargaining coordination		0.07		0.41 **		-0.15
Labour tax rate x wage bargaining coordination squared		-0.03 *		-0.07 **		0.03
DIAGNOSTICS						
R^2 (within)	0.830	0.836	0.819	0.824	0.970	0.985
Bootstrapped DF cointegration test p-value (c)	0.22	0.25	0.81	0.81	0.29	0.31
N.Observations (countries) (d)	401 (19)	401 (19)	586 (19)	586 (19)	586 (19)	586 (19)

Notes:

(a) including country specific fixed effects, country specific time trends and time dummies

(b) including country specific fixed effects and country specific time trends

(c) the null hypothesis is no cointegration

(d) Greece is missing due to lack of data for wage bargaining coordination.

**: statistically significant at 5%; *: statistically significant at 10%

Table 4. Regression results for the employment rate in hours: the fiscal view

	(1)	(2)	(3)	(4)
Estimation method	CCEP (AR) (a)	CCEP (b)	CCEP (AR) (a)	CCEP (b)
Estimation period	1970-2005	1970-2005	1970-2005	1970-2005
Labour tax rate	-0.06	-0.58 **	-0.41	-0.51
Benefit replacement rate	-0.046 **	-0.052 **	-0.053 *	-0.056 **
Consumption tax rate	-0.10	-0.11 *	0.04	0.08
Capital tax rate	0.04 **	0.04 **	0.03	
Productive government spending in percent of GDP	-0.25 **	-0.38 **	-0.10	
Government wage consumption in percent of GDP	0.12	-0.05	-0.04	
Government non-wage consumption in percent of GDP	0.34 **	0.34 **	0.19	
Output gap	0.40 **	0.39 **	0.32 **	0.38 **
Interaction terms				
Labour tax rate x social expenditures in percent of total expenditures		0.004	-0.011	-0.011
Labour tax rate x productive government spending in percent of total expenditures		0.018 **	0.021 **	0.017 **
Labour tax rate x gov. wage consumption in percent of total expenditures		0.015 **	0.003	0.015 *
Labour tax rate x non-wage consumption in percent of total expenditures		-0.008 **	-0.003	-0.002
Labour tax rate x wage bargaining coordination			0.154 *	0.147 **
Labour tax rate x wage bargaining coordination squared			-0.019	-0.015

DIAGNOSTICS	Test-stat	p-value	Test-stat	p-value	Test-Stat	p-value	Test-stat	p-value
H0: no autocorrelation	25.74	0.00	1.054	0.30	19.11	0.00	1.43	0.23
H0: no moving_average	5.07	0.00	1.027	0.15	4.37	0.01	1.20	0.12
R^2 (within)	0.968		0.989		0.988		0.989	
Bootstrapped DF cointegration test p-value (c)	0.02		0.03		0.01		0.02	
N.Observations (countries) (d)	621 (19)		621 (19)		581 (18)		581 (18)	

Predictions of **column (2)** using average actual fiscal policy data for 2000-05: effects on employment rate in hours in percentage points

	Core euro area 6	Nordic 4	US
Effect of 1 %-point increase in labour tax rate	-0.16	0.01	0.07
Effect of 1 %-point increase in productive gov. spending / GDP	1.07	1.07	0.83
Effect of 1 %-point increase in wage consumption / GDP	1.16	1.16	0.96
Effect of 1 %-point increase in non-wage consumption / GDP	-0.30	-0.30	-0.20

Notes:
(a) including country specific fixed effects and country specific time trends and allowing for an AR(1) process in the residuals. The autocorrelation test statistic at the bottom of the table is for the regression where we do not allow for this AR(1) process.
(b) including country specific fixed effects and country specific time trends (c) the null hypothesis is no cointegration
(d) Australia is missing in each column due to lack of data on the components of government consumption (wage / non-wage). Greece is missing in columns (3) and (4) due to lack of data for wage bargaining coordination

**: statistically significant at 5%; *: statistically significant at 10%

The bottom part of Table 4 applies the results in column (2) to obtain predictions of fiscal policy effects on the employment rate in hours in two European country groups and the US. We rely on actual fiscal policy data for 2000-05 (see Appendix 3). Daveri and Tabellini (2000) and Berger and Everaert (2007) find that labour taxes have an adverse effect on (un)employment only in continental European countries. They find no effect in Anglo-Saxon and Nordic countries. Their explanation is related to wage bargaining institutions. We confirm Daveri and Tabellini's cross-country differences, although estimated tax effects are much smaller than in their study. However, from our results in Tables 3 and 4 (bottom part), it seems clear that the reason for these cross-country differences is the composition of government expenditures, rather than labour market institutions. A key issue is the lower share of productive government spending in the core euro area, compared to the Nordic countries and the US. The Nordic countries also have a higher share of wage consumption. Taking into account the added interaction terms also changes the sign of the net effect of productive government expenditures in percent of GDP. Column (2) predicts for both European country groups a positive employment rate effect of about 1.1 percentage points when productive spending rises by 1 percent of GDP[3]. The effect of wage consumption is also positive and has about the same size. The employment rate effect of raising non-wage consumption is negative[4].

Figure 2 depicts the evolution over time of the employment effect of a 1 percentage point increase in the labour tax rate. We compare the CCEP-estimates from column (2) for the core euro area countries, the Nordic countries and the Anglo-Saxon countries. This figure not only confirms that labour tax effects are more negative in the core euro area, it also shows a much stronger worsening of this effect over time, in particular during the 1990s. Data in Appendix 3 show that whereas the other country groups have been able to raise the share of productive spending since the mid 1990s, the core euro area countries have not. We have repeated the exercise in Figure 2, but then using the standard fixed effects estimator[5]. We observe that fixed effects estimates are much more negative. For the core euro area for example the estimated tax effect in 2005 would be about -0.60 (instead of -0.18 in Figure 2). In line with our earlier arguments, of course, we should be very cautious about this result. But it may explain why some other studies, using the fixed effects estimator, find such big labour tax effects.

We have run a series of additional regressions in which we extend the fiscal policy model with labour and product market institutions. We report the main results in Table 4, columns (3) and (4). A first major finding is that our conclusions about the sign and the importance of the effect of most fiscal policy variables survive (except for the consumption and the capital tax rate). The institutional variables however generally show up insignificant. We have extended the regressions in Table 4 with employment protection legislation, product market regulation and union density. They never show up significant[6]. Only the wage bargaining coordination variable is significant in interaction with the labour tax rate. If we add it separately (as well as its square), all parameters related to wage bargaining coordination become insignificant. An interesting observation is that the relationship between coordination and the employment effect of taxes is

[3] The labour tax rate is about 40% and the share of total government expenditures in GDP almost 50% in both European country groups (see also Appendix 3).

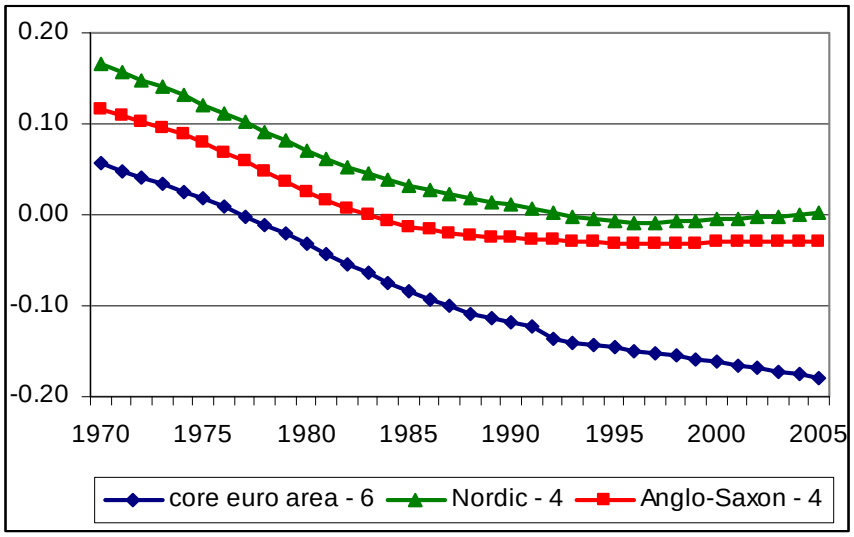
[4] The differential employment effect of wage versus non-wage consumption may illustrate Rogerson's (2007) prediction, at least if it can be assumed that households consider government wage consumption (excluding wages in education) to be less useful than non-wage consumption.

[5] We do not show these results, they are available upon request.

[6] These results are available from the authors upon request.

upward sloping in the relevant range of coordination data. Controlling for differences in fiscal policy, a higher degree of coordination reduces the negative tax effect. Note that even when we introduce the interaction with wage bargaining coordination in Table 4, the interaction terms between the labour tax rate and some of the government expenditure shares remain significant.

Figure 2. Effect on the employment rate in hours (in percentage points) of a 1 percentage point labour tax rate increase: CCEP-estimates for three country groups (Table 4, column 2)



Further discussion and robustness

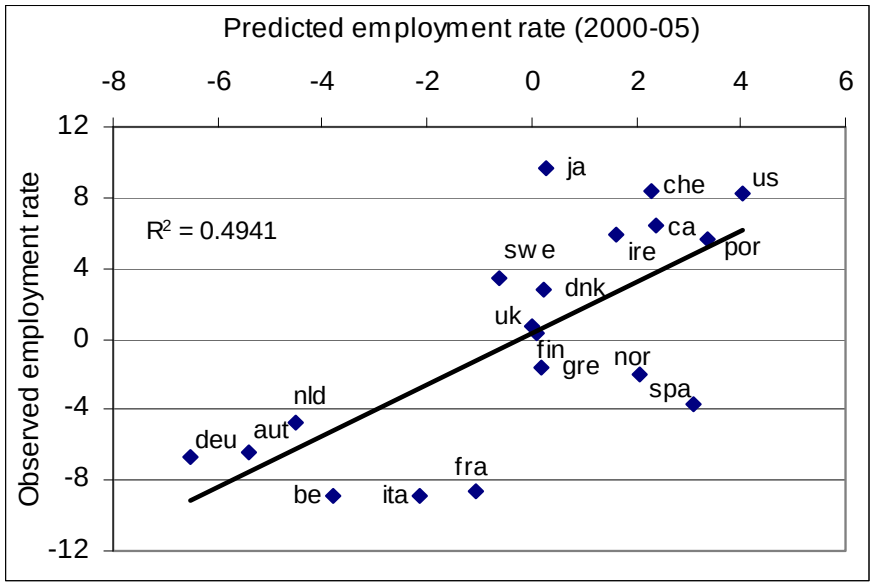
Figure 3 further tests the capacity of our 'best' fiscal model in Table 4 to explain the variation of employment in hours over time and across countries. We use the regression result in column (2)[7]. The upper panel of the figure relates our models' prediction (economic explanation) for the *level* of the employment rate in hours in 2000-05 to the true observation. Both prediction and true observation are represented as deviations from their overall country averages. The lower panel of each figure relates predicted and observed *changes* in the employment rate between 1982 and 2005. We emphasize that our predictions in both panels have been obtained solely from using the 'economic' part of the estimated equations. They do not include the country-specific fixed effects, the country-specific time trends and the country-specific approximations for the unobserved common factors in Equation (2). Correlation in each panel is above 0.65. Our 'best' fiscal model clearly explains well, at least for the last 25 years. We have to recognize though that the explanatory power of the 'economic' part of the estimated equation is much lower for the 1970s and early 1980s. It seems that to explain the drastic drop in employment in many countries between the early 1970s and early 1980s (see Figure 1 or Appendix 1), other factors were dominant.

[7] We obtain highly similar results when we use the regression outcomes in columns (3) or (4). These results are available upon request.

Figure 3.

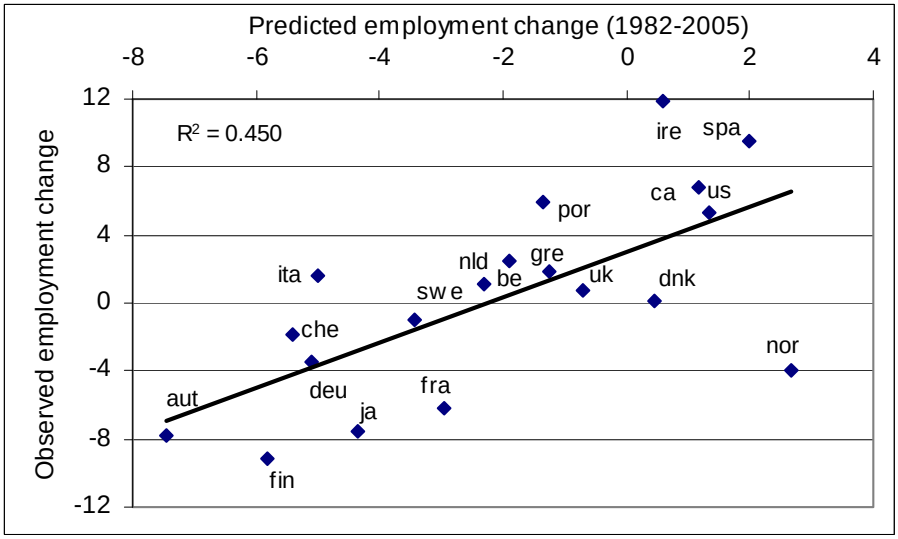
3A. Predicted and observed employment levels, 2000-05.

(Prediction based on column 2 in Table 4)



Note: Both prediction and observation are in deviation from their overall country average. Predictions do not include country-specific fixed effects, country-specific time trends or country-specific approximations for the unobserved common factors in Equation (2).

3B. Predicted and observed changes, 1982-2005



Note: Germany (deu, 1992-2005), Switzerland (che, 1990-2005)

In Table 5 we test the robustness of our results, using the employment rate in persons (OECD data) as the dependent variable. Columns T3(2) and T3(5) test the institutional view, column T4(2) the fiscal view. Our main findings for the employment rate in hours also hold for the employment rate in persons. Using the fixed effects estimator we obtain statistically significant and well-signed coefficients for most variables in T3(2) (labour tax, benefit replacement rate, consumption tax, product market regulation, wage bargaining coordination, output gap). However, the institutional

Table 5. Regression results for the *employment rate in persons* (○)

	T3(2)	T3(5)		T4(2)
Estimation method	Fixed effects (a)	CCEP (AR) (b)	Estimation method	CCEP (AR) (b)
Estimation period	1982-2003	1970-2003	Estimation period	1970-2005
Labour tax rate	-0.76 **	0.02	Labour tax rate	-0.15
Benefit replacement rate	0.13 **	0.05 *	Benefit replacement rate	-0.03 *
Consumption tax rate	-0.19 **	0.00	Consumption tax rate	-0.06
Union density rate	-0.04	-0.15 **	Capital tax rate	0.01
Employment protection legislation	4.10 **	0.41		
Product market regulation	-1.57 **	0.36	Productive gov. spending in percent of GDP	-0.23 **
Coordination of wage bargaining	-13.5 **	-3.88 **	Government wage cons. in percent of GDP	0.18 **
Coordination of wage bargaining squared	2.82 **	0.70 **	Government non-wage cons. in percent of GDP	0.10
Output gap	0.34 **	0.34 **	Output gap	0.33 **
Interaction terms				
Labour tax rate x wage bargaining coordination	0.409 **		Labour tax rate x social expenditures in percent of total expenditures	-0.008
Labour tax rate x wage bargaining coordination squared	-0.08 **		Labour tax rate x productive government spending in percent of total expenditures	0.015 **
			Labour tax rate x gov. wage consumption in percent of total expenditures	0.010 *
			Labour tax rate x non-wage consumption in percent of total expenditures	-0.007
DIAGNOSTICS				
R^2 (within)	0.736	0.968	R^2 (within)	0.980
Bootstrapped DF cointegration test			**Bootstrapped DF cointegr. test**	
p-value (c)	0.19	0.39	p-value (c)	0.04
N.Observations (countries)	401 (19)	586 (19)		621 (19)

Predictions of column T4(2) using average actual fiscal policy data for 2000-05: effects on employment rate in persons in percentage points			
	Euro area 6	Nordic 4	US
Effect of 1 %-point increase in labour tax rate	-0.21	-0.06	-0.01
Effect of 1 %-point increase in productive government spending / GDP	0.94	0.94	0.75
Effect of 1 %-point increase in wage consumption / GDP	0.99	0.99	0.86
Effect of 1 %-point increase in non-wage consumption / GDP	-0.45	-0.45	-0.36

Notes: (°) column numbers are those of the corresponding columns in Tables 3 and 4.

(a) including country specific fixed effects, country specific time trends and time dummies

(b) including country specific fixed effects and country specific time trends and allowing for an AR(1) process in the residuals.

(c) the null hypothesis is no cointegration

**: statistically significant at 5%; *: statistically significant at 10%

model again fails to capture the permanent movements in the employment rate. Results are again spurious, also when we use the CCEP estimator in T3(5). Extending the latter equation with interaction terms in wage bargaining and the labour tax rate does not change this conclusion. These additional interaction terms are insignificant. In column T4(2) we reject the null hypothesis of no cointegration. The estimation results in this column confirm for employment in persons that the negative effect of labour taxes mainly occurs in the core euro area country group (see bottom of the table). This effect is much smaller in the Nordic countries and the US. Column T4(2) also supports the positive effects of a high share of productive government expenditures and a high share of government wage consumption as robust results. A high benefit replacement rate and a high share of social benefit expenditures tend to have a negative effect, although the latter effect is insignificant.

6. Conclusions

The current level of per capita hours worked differs widely across OECD countries. So does its evolution during the last decades. The reasons for these differences across countries and over time have been the subject of intense discussion in recent economic literature. Two broad views seem to have emerged. A first group of studies emphasize the key role of differences in labour and product market characteristics and rigidities. A second group of studies put fiscal policy differences at the centre of the explanation, and pay no serious attention to labour or product market rigidities. In this paper we test the explanatory power of both views econometrically in a panel study for 20 OECD countries in 1970-2005.

Unlike the standard fixed effects estimator for panel data, our empirical strategy allows for the possibility of cross-sectionally correlated error terms due to unobserved common factors which are potentially non-stationary. We use the Common Correlated Effects Pooled (CCEP) estimator as developed by Pesaran (2006) and Kapetanios et al. (2006). Our observation in this paper that the fixed effects estimator generally yields spurious results, underscores the need for a careful treatment of the time-series properties of the data in empirical macro labour studies.

Our results support the fiscal view. We find that hours worked rise when labour taxes and non-employment benefits fall and when the shares of productive government expenditures and government wage consumption rise. We obtain a negative impact of consumption taxes in some regressions, but this result is not robust. We find no negative effect of capital taxes. Exploiting differences in fiscal policy, we can explain much of the current variation in the *levels* of hours worked between the US and Europe, as well as between individual European countries. We can also explain a large fraction of cross-country differences in the *change* in hours worked since 1982. Differences in (the evolution of) labour and product market institutions have much less of a role to play. Our results also reveal that well-known differences between continental European, Nordic and Anglo-Saxon countries in the impact of labour taxes on employment (Daveri and Tabellini, 2000) are much more likely due to differences in the structure of government expenditures than to differences in wage bargaining institutions. If wage bargaining institutions matter, our results suggest a monotonic relationship with the negative effect of taxes falling in the degree of coordination.

The policy implications of our results for the core countries of the euro are fully in line with those emphasized by e.g. Rogerson (2007) and Dhont and Heylen (2009). From an employment perspective it would seem necessary to cut non-employment benefits and tax rates on labour, and to raise the share of productive government expenditures.

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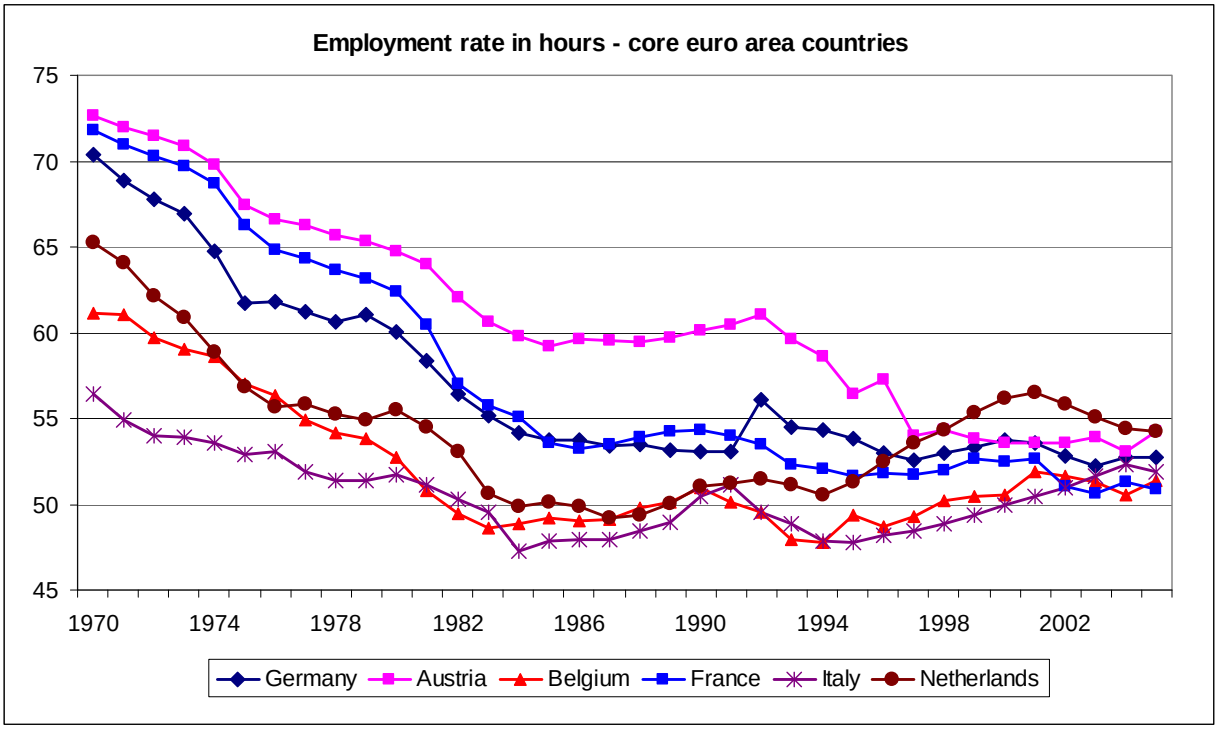
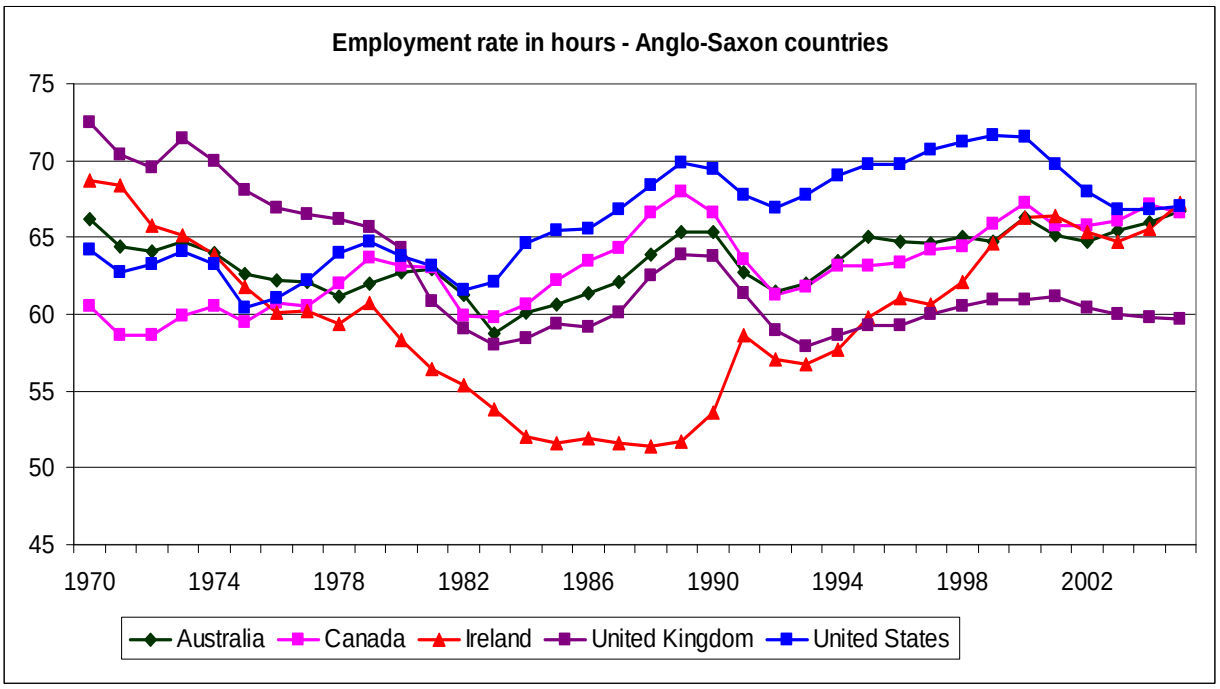
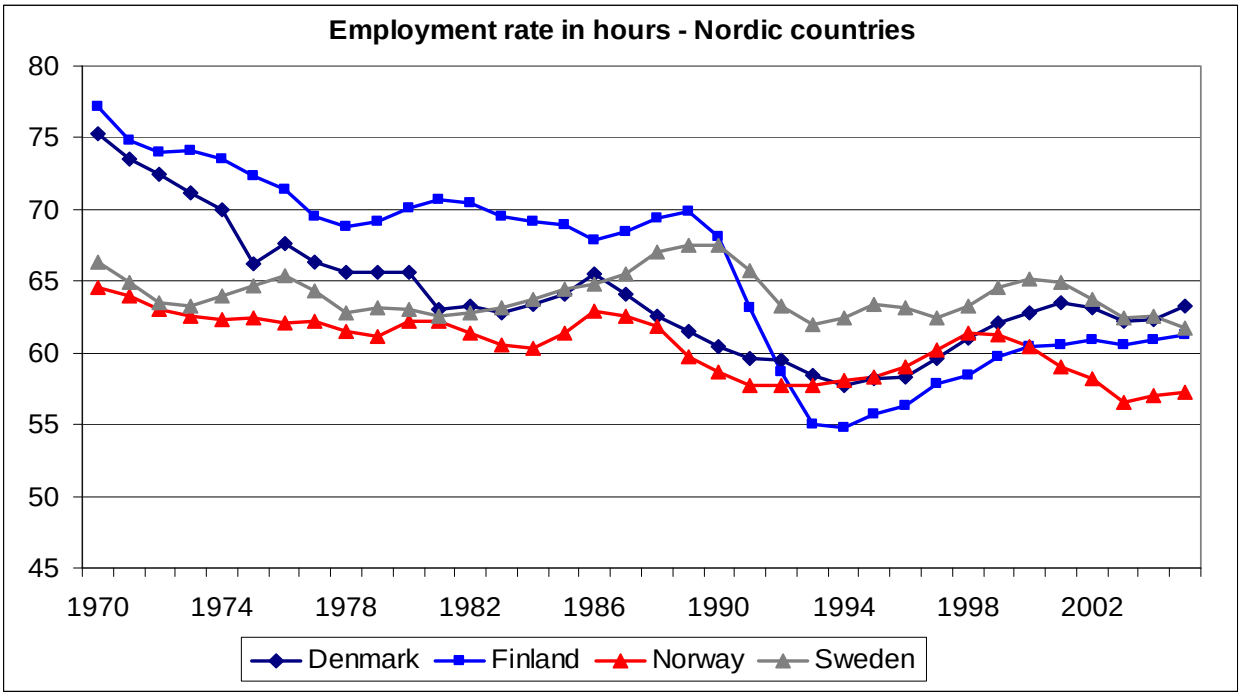
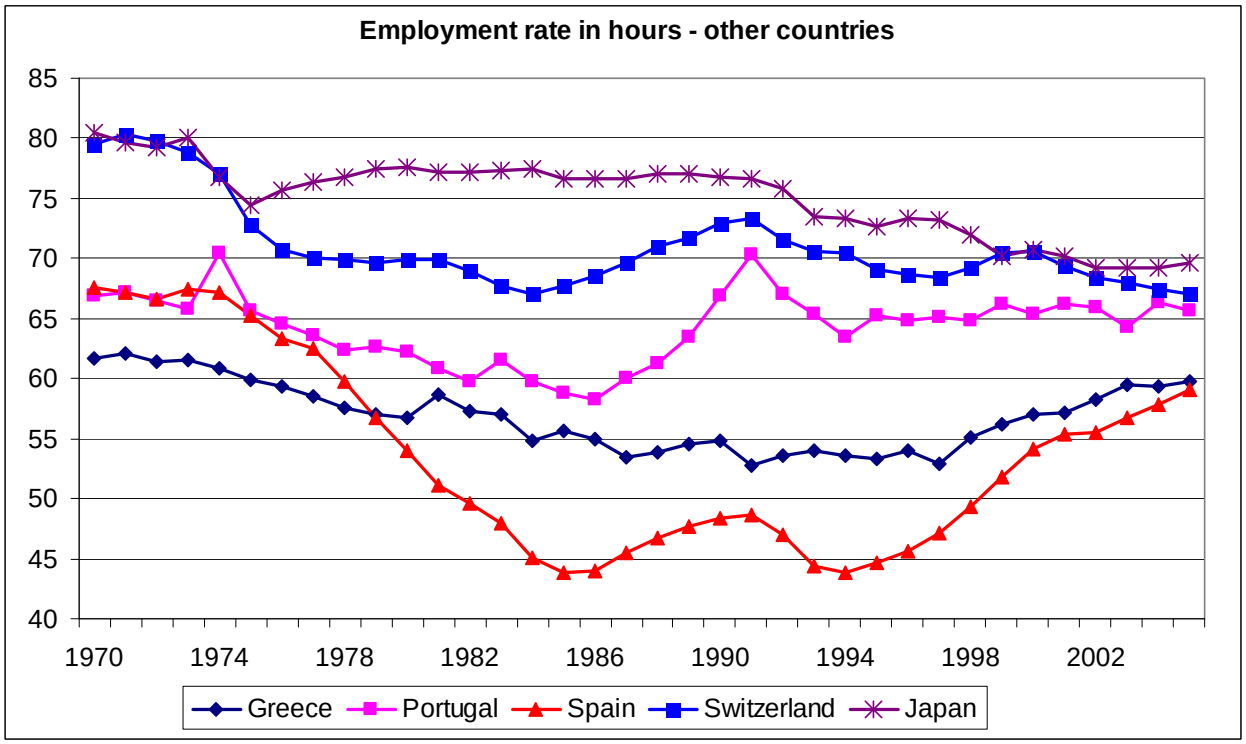
Appendix 1. Employment rate in hours in individual countries, in %, 1970-2005






Employment rate in hours - Nordic countries
80
75
70
65
60
55
50
45
1970
1974
1978
1982
1986
1990
1994
1998
2002
Denmark
Finland
Norway
Sweden


Employment rate in hours - other countries
85
80
75
70
65
60
55
50
45
40
1970
1974
1978
1982
1986
1990
1994
1998
2002
Greece
Portugal
Spain
Switzerland
Japan

Appendix 2. Data description and sources

Employment rate in hours:
Definition: average hours worked per person of age 15 to 64 in percent of fulltime hours. Calculated as total aggregate hours worked, divided by 1920 times population at working age. We assume that a full time worker potentially supplies 1920 hours per year (40 hours per week times 48 weeks).
Sources: Aggregate hours worked: The Conference Board and Groningen Growth and Development Centre, Total Economy Database, January 2008; Population at working age (15 to 64): OECD Stat, Annual Labour Force Statistics.

Labour tax rate:
Definition: implicit labour tax rate, in percent of labour cost.
Calculated as the ratio of the sum of non-wage labour costs *and* personal income tax revenues attributable to labour income, to total labour costs. The latter includes total compensation of employees as well as wages (plus social security contributions) imputed to the self-employed.
Source: Martinez-Mongay (2000, his LETR), updated until 2005 by Martinez-Mongay. We calculated the same series using comparable OECD data for Australia, Canada, Norway and Switzerland, which are not included in Martinez-Mongay's dataset. Correlation between the labour tax rate in EU countries computed with OECD data and the Martinez-Mongay series is always very high (> 97%).
Data shortages: Data for Switzerland are available since 1990 only.

Consumption tax rate:
Definition: We have calculated our proxy for the tax rate on consumption according to the formula below (see also Dhont and Heylen, 2009). An important underlying assumption is that consumption tax rates correspond to aggregate indirect tax rates:

$$TAXC = \frac{TIND - SUBS}{TDD - (TIND - SUBS)} 100$$

with *TIND* nominal indirect taxes received by the government, *SUBS* nominal subsidies paid by the government and *TDD* nominal total domestic demand. We calculated the latter as real total domestic expenditure times its deflator.
Source: OECD, Statistical Compendium, Economic Outlook (series TIND, TSUB, TDDV and PTDD).
Data shortages: Data are available since 1975 only for Australia, since 1977 only for Portugal, since 1990 only for Switzerland and since 1991 only for Germany.

Capital tax rate:
Definition: The results that we present in Tables 4 and 5 include the statutory corporate income tax rate, in percent.
Source: OECD Tax Database (Table II.1, Corporate income tax rate). We use the combined corporate income tax rate, including both central and sub-central government taxes.
Data shortages and adjustments: The OECD does not present data for 1970-80. These data have been added from national sources for all countries except Italy, Greece, Japan, US, Portugal and Switzerland. For Italy, Greece, Japan and US we could exploit (extrapolate) information in the

World Tax Database. This data source provides top marginal tax rates on corporations (http://www.bus.umich.edu/OTPR/otpr/introduction.htm). For Portugal and Switzerland no consistent data were available before 1981.

As an alternative, we calculated an implicit capital income tax rate in line with Martinez-Mongay (2000, his KETG). This alternative rate reflects the sum of taxes on personal income from capital, taxes on corporate income and property taxes, as a percentage of gross operating surplus (adjusted for the imputed wage income of the self-employed). Data sources: OECD, Statistical Compendium, Government Revenue Statistics and Economic Outlook. Data for Portugal and Switzerland are available only since 1989 and 1990 respectively.

Productive government spending in percent of GDP:
Definition: sum of nominal public expenditures on education and government fixed capital formation, in percent of nominal GDP.
Sources: Public expenditures on education for 1970-96 have been taken from the online UNESCO database, available at http://www.uis.unesco.org/i_pages/IndPGNP.asp. Data for 1998-2005 have been taken from OECD, Education at a Glance, 2001-2008. Data for nominal GDP and nominal government fixed capital formation have been taken from OECD, Statistical Compendium, Economic Outlook (series GDP, IGAA).
Data adjustments: UNESCO data for the period 1970-1980 are available only for the years 1970, 1975 and 1980. We have calculated data for the intermediate years by interpolation. UNESCO presents its data in percent of GNP. Given significant differences between GNP and GDP in Ireland, we have multiplied UNESCO data times the ratio of GNP to GDP for this country. Data for 1997 have been obtained by interpolation.

Government non-wage consumption in percent of GDP
Sources: OECD, Statistical Compendium, Economic Outlook (series CGNW, GDP)

Government wage consumption in percent of GDP
Calculated as government wages minus 85% of public expenditure on education.
Consumption expenses (mainly wages) constitute approximately 85% of total education spending (see also Dhont and Heylen, 2008, 2009). Since education expenditures are included in productive expenditures, we deduct this amount from the reported data on government wage consumption.
Sources: OECD, Statistical Compendium, Economic Outlook

Social government expenditures in percent of GDP:
Definition: our data are nominal social security benefits paid by general government, in percent of nominal GDP.
Source: OECD, Statistical Compendium, Economic Outlook (series SSPG and GDP)

Government expenditures in percent of total expenditures:
Source for total government expenditures: OECD, Statistical Compendium, Economic Outlook (series YPGT).
Data adjustments: In our regressions we include the Hodrick-Prescott trend of the expenditure shares in the interaction term with the labour tax rate. This trend better reflects the structural composition of government spending.

Gross benefit replacement rate:
Definition: average unemployment benefit replacement rate across two income situations (100% and 67% of APW earnings), three family situations (single, with dependent spouse, with spouse in work) and three different unemployment durations (1st year, 2nd and 3rd years, and 4th and 5th years of unemployment).
Source: OECD, Benefits and Wages Database. (see also Bassanini and Duval, 2006).
Data adjustments: original data are available only for odd years. Data for even years are obtained by linear interpolation.

Employment Protection Legislation:
Definition: OECD summary indicator of the stringency of Employment Protection Legislation. We use the overall EPL strictness indicator (time series, version 1).
Source: OECD, *Employment Outlook* 2004; see also Online OECD Employment Database.
Data shortages and adjustments: Data are available only for 1985-2003. For 1970-84 we rely on Nickell and Nunziata (2001). We use their data to extrapolate the OECD data backwards from 1985 to 1970, respecting relative changes. Nickell and Nunziata rely on Blanchard and Wolfers (2000).

Union density:
Definition: trade union density rate, *i.e.* the share of workers affiliated to a trade union, in %.
Source: OECD, *Employment Outlook* 2004; see also Online OECD Employment Database.
Data adjustments: Missing data for some years in Australia have been obtained by linear interpolation, following Bassanini and Duval (2006). Missing data for Greece in 1970-79 and Portugal in 1970-77 have been obtained by backward extrapolation using administrative trade union density data from OECD Statistical Compendium (Labour Market and Social Issues Database). Union density for Spain in 1970-80 has been assumed equal to its level in 1981. Here we follow Nickell and Nunziata (2001), who also have constant union density in Spain in this period. The above mentioned OECD datasets contain no data for 2003. Bassanini and Duval (2003) expanded these datasets. We adopted their data for 2003. Data are not available for 2004-05.

Product Market Regulation:
Definition: OECD summary indicator of regulatory impediments to product market competition in seven non-manufacturing industries (telecoms, electricity, gas, post, rail, air passenger transport, and road freight).
Source: Conway, P., D. De Rosa, G. Nicoletti, and F. Steiner (2006); see also OECD.Stat, Public Sector, Taxation and Market Regulation (REGREF dataset)
Data shortages and adjustments: data are available only since 1975. We follow Bassanini and Duval (2006) in assuming constant product market regulation in 1970-75. Data are not available for 2004-05.

Coordination of Wage Bargaining:
Definition: Index for the degree of intentional harmonization in the wage setting process, for the degree to which "minor players" deliberately follow along with what the "major players" decide. The coding for the index is based on structural characteristics of the wage bargaining process.

1 = Fragmented wage bargaining, confined largely to individual firms or plants (Canada, Ireland 1960-69 and 1981-87, United Kingdom since 1980, United States).
2 = Mixed industry- and firm-level bargaining, with little or no pattern-setting and relatively weak elements of government coordination such as setting of basic pay rate or wage indexation (Australia since 1992, France, Italy in most years);
3 = Industry-level bargaining with somewhat irregular and uncertain pattern-setting and only moderate union concentration (Belgium in the second half of the 1970s, Denmark in most years since 1981, Finland in a few years, Sweden since 1994); Government wage arbitration (Australia prior to 1981);
4 = Centralized bargaining by peak confederation(s) or government imposition of a wage schedule/freeze, without a peace obligation (Belgium and Finland in most years, Ireland 1970-80 and 1987-93); Informal centralization of industry- and firm-level bargaining by peak associations (Italy since 1993, Netherlands since 1983, Norway in some years, Switzerland); Extensive, regularized pattern-setting coupled with a high degree of union concentration (Germany, Austria since 1983);
5 = Centralized bargaining by peak confederation(s) or government imposition of a wage schedule/freeze, with a peace obligation (Denmark 1960-80, Ireland since 1994, Norway in many years, Sweden 1960-82); Informal centralization of industry-level bargaining by a powerful, monopolistic union confederation (Austria prior to 1983); Extensive, regularized pattern-setting and highly synchronized bargaining coupled with coordination of bargaining by influential large firms (Japan).
Source: Kenworthy (2001).
Data shortages and adjustments: For each country we have computed the Hodrick-Prescott trend of the original Kenworthy index, and introduced this trend into our regressions. This approach allows us to smooth out jumps in the original series when bargaining structures change. The underlying idea is that the effect of changes in wage bargaining structures on wage setting and employment is gradual after all.

Kenworthy data are not available for Greece, Portugal and Spain. For the latter two countries we have created our own proxy, exploiting the very high correlation between the (trend) Kenworthy coordination index (KC) and the time varying bargaining coordination index (BC2) of Nickell and Nunziata (2001). More precisely, we ran a regression of KC on a constant, BC2 and its square over all 17 common countries in 1970-98 ($R^2adj=0.71$). From the available data for Spain and Portugal in the Nickell-Nunziata database, we were able to derive our proxy for KC. Nickell and Nunziata do not have data for Greece.

Original Kenworthy data are available only until 2000. We expand these original data until 2003 at the level of 2000. There is a minor change only for Finland, justified by more recent information (see Asplund, 2007). Bassanini and Duval (2006) also have an unchanged "corporatism" index for each country in 2000-2003. We extrapolated the Kenworthy HP trend until 2005.

Reference:
Asplund, R. (2007), Finland: Decentralisation tendencies within a collective wage bargaining system, *ETLA Discussion Papers*, Research Institute of the Finnish Economy, N° 1077.

Appendix 3. Fiscal policy data in three country groups

	Labour tax rate (%)	Social expenditures in % of total expenditures	Productive government spending in % of total expenditures	Government wage consumption in % of total expenditures	Non-wage consumption in % of total expenditures	Total government expenditures in % of GDP
1970-73						
Euro area-6	28.5	30.5	23.1	15.7	17.0	40.8
Nordic-4	30.7	23.8	28.2	18.0	16.3	40.1
US	19.6	24.3	35.0	15.9	19.7	32.0
Anglo-S-4	17.1	20.8	28.3	15.9	17.1	38.6
1980-83						
Euro area-6	36.2	32.1	18.3	14.7	16.8	52.5
Nordic-4	37.3	27.2	20.5	19.2	14.9	52.9
US	23.0	27.7	28.6	14.7	17.9	35.6
Anglo-S-4	22.2	24.8	21.8	16.2	16.8	46.1
1993-95						
Euro area-6	40.2	32.6	15.2	13.0	18.8	53.2
Nordic-4	42.1	31.5	18.2	16.5	14.4	61.7
US	23.5	30.1	23.3	15.3	15.2	37.3
Anglo-S-4	24.2	29.1	19.3	15.3	16.7	44.0
2000-05						
Euro area-6	39.4	33.7	15.2	12.3	21.4	48.9
Nordic-4	41.4	31.7	19.4	16.7	17.1	51.5
US	24.2	32.5	23.8	14.1	15.6	35.9
Anglo-S-4	23.6	28.9	20.5	15.2	19.0	37.9

Note: for definition of country groups, see Figure 1. Anglo-Saxon-4 is US, UK, Ireland and Canada.