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WORKING PAPER

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

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

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Abstract

We study 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 per capita hours worked across countries and over time can be explained by differences in the level and structure of taxes and government expenditures. Differences in (the evolution of) labor 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, labor market institutions, panel data
JEL: C33, E24, E62, H20

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1. Introduction

Per capita 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 2003-2007. This variable expresses actual hours worked in percent of potential full-time hours. Employment rates range from a little more than 50% in France, Belgium and Italy to more than 67% in Canada, the US, Switzerland and Japan. Figure 1 depicts the evolution since 1970 in four fairly homogeneous country groups. In 1970 differences across these country groups were relatively small. In each group 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 core countries of the euro area fell from 66% in 1970 to less than 55% in the most recent years. In the main Anglo-Saxon countries the employment rate was still at 66% on average in 2007, 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 62% since 2000. This leaves the Nordic group closer to the Anglo-Saxon countries than to the core euro area.

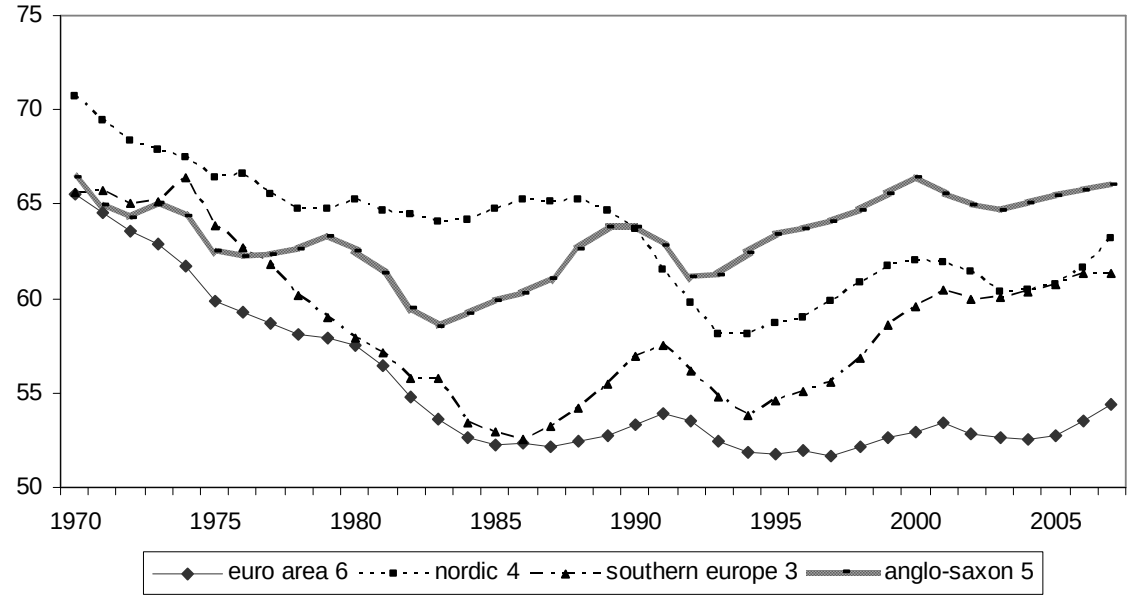
The reasons for these differences across countries and over time have been the subject of intense discussion in recent economic literature. Almost all studies emphasize the role of unemployment benefit systems and labor taxes, although the importance attached to them may differ. As to other determinants, two broad views seem to have emerged. A first group of authors see a major role for labor and product market characteristics, like employment protection legislation, union power, wage bargaining systems, and barriers to entry (e.g. Bean, 1994; Blanchard and Wolfers, 2000; Nicoletti and Scarpetta, 2005; Alesina et al., 2005; Nickell et al., 2005; Bassanini and Duval, 2006; Faggio and Nickell, 2007). Other authors explore in greater detail the influence of fiscal policy. In their view, differences in the level and composition of taxes and government expenditures are key to explain differences in employment. Many of the studies in this second group pay no attention to labor or product market rigidities (Prescott, 2004; Rogerson, 2007; Ohanian et al., 2008; Dhont and Heylen, 2008, 2009; Olovsson, 2009). Others (e.g. Daveri and Tabellini, 2000; Berger and Everaert, 2010) emphasize that the effects of tax changes may depend on labor market institutions. Our aim in this paper is to test the explanatory power of both views econometrically in a panel of OECD countries in 1970-2007. To the best of our knowledge, the second view has hardly been tested econometrically. Moreover, earlier econometric panel studies have typically investigated either the unemployment rate or the employment rate in persons, i.e. the extensive margin in hours worked. Faggio and Nickell (2007) and Causa (2008) are exceptions: they have (also) studied the determinants of hours worked per employed person, the intensive margin. With the employment rate in hours as our main dependent variable in this paper, we include both margins. We will however also run separate regressions for the employment rate in persons and for hours per employed. 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.

Table 1. Employment rate in hours[a], in %, 2003-2007

Lower than 56%		Between 56% and 65%		Higher than 65%	
France	51.5	Spain	56.7	Portugal	65.6
Belgium	51.9	Norway	57.9	Australia	66.2
Italy	52.4	United Kingdom	59.5	Ireland	66.9
Germany	53.2	Greece	60.1	Canada	67.1
Austria	54.7	Finland	61.6	United States	67.3
Netherlands	55.2	Sweden	62.1	Switzerland	68.9
		Denmark	63.4	Japan	70.1

(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, June 2009; Population at working age : OECD Stat, Annual Labour Force Statistics.

Figure 1. Employment rate in hours in four country groups, in %, 1970-2007



Note: Euro area 6: Austria, Belgium, France, Germany, Italy, Netherlands; Anglo-Saxon 5: Australia, Canada, Ireland, UK, US; Nordic 4: Denmark, Finland, Norway, Sweden; Southern Europe 3: Greece, Portugal, Spain. Data for individual countries, also including Japan and Switzerland, are reported in Appendix 1.
Sources: see Table 1.

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 describes our data. In Section 4 we motivate and 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 labor and consumption tax rates and in the composition of government expenditures explain much of the variation in hours worked both across countries and over time, at least since the 1980s. By contrast, differences in labor or product market

institutions cannot explain the variation in hours worked. We find that hours worked fall when labor taxes, consumption taxes, social benefit expenditures and public non-wage consumption are increased, and when productive government expenditures are reduced. Further analysis reveals that most of these effects operate along the extensive margin in aggregate hours worked. Finally, we observe that the size of the negative labor tax effect depends on the composition of government expenditures. Tax effects are smaller for example when the share of productive expenditures is higher. 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 labor 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.

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 labor market and product market institutions. Prominent labor 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 labor 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. Labor 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 labor 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

[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 labor 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.

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 (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 labor 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 (e.g. Nickell et al., 2005; Bassanini and Duval, 2006; Estevão, 2007). 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 labor 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 labor 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; Estevão, 2007).

The influence of *product market regulation* on labor 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, labor 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 *labor taxes* and – although much less frequently –

government spending on active labor market policies (Estevão, 2007). 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; Cardia et al., 2003; Prescott, 2004; Rogerson, 2007; Ohanian et al., 2008; Dhont and Heylen, 2008, 2009; Olovsson, 2009). In general these models assume perfect competition. Cross-country differences in labor market rigidity are considered not to be critical. An important early contribution to this literature has been made by Baxter and King (1993).

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 types of government expenditures according to their effects on employment. Taxes on labor exert the most negative effect on employment. Higher labor taxes diminish the marginal utility gain from working compared to leisure or non-market activities. Individuals will cut labor 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 labor productivity, wages and labor supply. Higher consumption taxes also make workers cut labor supply and employment, but their effects are smaller. Compared to labor taxes, a key difference is that 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' labor-leisure choice. They mainly operate through their negative effects on physical capital formation and labor 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. Taxes generate the strongest drop in employment if tax revenue is used to finance non-employment benefits. These benefits are conditional on the individual not being at work. They are reduced if labor income rises. Examples are traditional unemployment benefits, early retirement benefits and disability benefits. Employment effects of raising taxes are very negative also when taxes are used to finance other transfers to households or useful government consumption. In the latter case the government may for example buy consumption goods at the market and transfer these to households. The reason for very negative employment effects 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 labor 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).

Baxter and King (1993) and Dhont and Heylen (2009) show positive effects of public infrastructure investment, education and active labor market policies. A key argument is that these expenditures raise labor productivity and therefore wages and the return to working. 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 labor 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 differences in labor and consumption taxes 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 labor supply elasticity and assumes that tax revenues are used to finance (lump sum) transfers to households. Ohanian et al. (2008) extend Prescott's analysis to more countries and a much longer time period. They also introduce additional explanatory variables. They confirm the key role of labor and consumption taxes to explain variation in hours worked across countries and over time. Labor market institutions add little explanatory power. 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 government 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. Labor market institutions and the employment effects of taxes

Bean (1994) and Blanchard and Wolfers (2000) argue that for a proper understanding of the evolution of (un)employment in OECD countries, it is crucial to take into account the interaction of aggregate shocks and institutions. The same driving shocks may be converted into very different (un)employment movements depending on country-specific institutions. Other authors have applied this idea to the effect of labor tax changes. Building on Calmfors and Driffill (1988), it has been shown by Daveri and Tabellini (2000) and Berger and Everaert (2010) that the (un)employment effects of labor 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, 2010, 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 labor taxes and employment. Existing macroeconometric studies also demonstrate 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; Estevão, 2007; Berger and Everaert, 2010) up to large (Daveri and Tabellini, 2000; Prescott, 2004). 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 institutions like the degree of coordination of wage bargaining. Furthermore, we deal with some remaining problems of econometric methodology (see Section 4).

3. Data

Our dataset consists of yearly observations for 20 OECD countries in 1970-2007. 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, the data for some institutional variables are available only until 2003 or 2005.

Our main dependent variable is the employment rate in hours which we have introduced in Section 1. Most of our regressions explain this variable. However, to distinguish between the extensive and intensive margins, we also run regressions explaining the employment rate in persons and regressions explaining average annual hours worked per employed. Key explanatory variables, which are important in both the labor market institutional model and the fiscal policy model, are the tax rate on labor income, the consumption tax rate and the gross unemployment benefit replacement rate. As a measure of labor taxes we use the implicit tax rate on employed labor 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 labor tax revenue, including social contributions, to the taxable base. Tax indicators based on this approach have been used in many empirical studies (e.g. Cardia et al., 2003; Planas et al., 2007; Daveri and Tabellini, 2000; Ohanian et al., 2008; Berger and Everaert, 2010). 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 labor 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 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 labor 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. At the expenditure side we include social security benefits, productive government expenditures and government consumption. Productive expenditures include education spending, government fixed investment and government financed R&D. The data for consumption are net of final public consumption expenditure in education. We split up consumption in a wage component and a non-wage component. A final fiscal variable in our regressions is the government financial balance.

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 labor market indicators

Macroeconomic aggregates of different countries are likely to be (partly) explained by common factors such as global shocks or common business cycle disturbances. Not all these factors are observable. Regarding labor markets, Bean (1994) derived a time series reflecting the sequence of common shocks behind unemployment in the OECD countries in 1956-92. Although he could relate a significant fraction of this time series to observable (common) variables like world GDP growth and the real oil price, a significant other fraction remained unexplained. Smith and Zoega (2008) have recently shown the existence of an unobserved common factor driving unemployment rates in 21 OECD countries. They estimate this common factor by the first principal component and find that it 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. As argued by Pedroni (2004), for instance, this cross-sectional correlation is likely to be heterogeneous across countries. 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.

Existing empirical macro labor studies have either neglected the econometric issues related to unobserved common factors behind (un)employment, or have only partially been able to deal with them. Bean (1994) and Blanchard and Wolfers (2000) are among the few studies in the second group. Bean for example keeps the effect of unobserved common factors out of the error term and avoids cross-sectional error dependence by introducing a sequence of time dummies with unrestricted specific effects on each country. In a second step Bean explains these specific effects as functions of labor market policies and institutions. In our empirical work we take advantage of the important progress that has recently been made in the panel data literature. The issue of cross-sectional error dependence has received much attention. 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 generalization 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, 2009, for details). Table 2 presents the test results. Almost all variables considered here are found to be non-stationary. Although the non-stationarity of labor market variables and thus the possibility of a spurious regressions problem are acknowledged in the literature, most studies ignore this issue. Noteworthy exceptions are Planas et al. (2007) and Berger and Everaert (2010) who estimate the labor 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 [(a)]
Employment rate in hours	15.4	1.00
Labour tax rate	44.2	0.30
Benefit replacement rate	20.9	0.99
Consumption tax rate	42.7	0.35
Capital tax rate	27.0	0.94
Productive government spending in percent of GDP	44.7	0.28
Government wage consumption spending in percent of GDP (net of government wages in education)	28.8	0.86
Government non-wage consumption spending in percent of GDP (net of non-wage consumption in education)	29.8	0.83
Social security benefits in percent of GDP	13.6	1.00
Union density rate	49.9	0.14
Employment protection legislation	64.8	0.01
Product market regulation	8.36	1.00

Note: (a) the null hypothesis is the presence of a unit root.

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 almost all 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 minimizing 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, 2009, for technical details).

5. Results

This section presents our empirical results. We test the explanatory power of the institutions view in Section 5.1. and the explanatory power of the fiscal view in Section 5.2. Most of our results explain the employment rate in hours. We discuss robustness and present some additional results for the employment rate in persons, and for average hours worked per employed, in Section 5.3.

5.1. Labor and product market institutions

Table 3 tests the labor and product market institutions view. Next to the CCEP estimator in columns (4) and (5), we also use the more frequent fixed effects estimator in columns (1) to (3). All fixed effects regressions also include a country-specific time trend and time dummies. Column (1) uses data for 1982-2005. Our results here are in line with most of the literature surveyed in Section 2.1. We find significant negative effects from labor taxes, the unemployment benefit replacement rate, union density and employment protection legislation. The estimated

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

	(1)	(2)	(3)	(4)	(5)
Estimation method	Fixed effects (a)	Fixed effects (a)	Fixed effects (a)	CCEP (b)	CCEP (b)
Estimation period	1982-2005	1970-2005	1970-2005	1970-2005	1970-2005
Labor tax rate	-0.26 **	-0.39 **	-0.51 **	-0.05	0.05
Benefit replacement rate	-0.09 **	-0.03	-0.03	-0.13 **	-0.14 **
Consumption tax rate	0.09	-0.10	-0.09	0.20 **	0.14 **
Union density rate	-0.29 **	-0.16 **	-0.16 **	-0.28 **	-0.33 **
Employment protection legislation	-0.78 *	1.47 **	1.42 **	-0.18	-0.24
Product market regulation	-0.41	-1.54 **	-1.55 **	0.68 **	0.45
Wage bargaining coordination	-0.99	0.98 *	-0.49	-0.47	4.60 *
Wage bargaining coordination squared	0.20 *	-0.10	0.08	0.06	-0.82 **
Output gap	0.48 **	0.46 **	0.46 **	0.28 **	0.24 **
Interaction terms					
Labor tax rate x wage bargaining coordination			0.06		-0.12
Labor tax rate x wage bargaining coordination squared			-0.01		0.02
DIAGNOSTICS					
R^2 (within)	0.816	0.836	0.836	0.970	0.984
Bootstrapped MW-EG cointegration test p-value (c)	0.338	0.353	0.227	0.140	0.160
N.Observations (countries) (d)	447 (19)	605 (19)	605 (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. When we use the CCEP estimator the Baltagi-test generally rejects the null of no autocorrelation. We therefore allow for an AR(1) process in the residuals.
(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%

effect from product market regulation is also negative, but it is statistically insignificant. Furthermore, our results tend to confirm the existence of a U-shaped relationship between the degree of wage bargaining coordination and employment. Finally, we obtain a significant positive effect for the output gap. The consumption tax rate is insignificant and has the wrong sign. Columns (2) and (3) cover the whole period 1970-2005. Compared with column (1), our results seem to be robust only for the labor tax rate, union density, product market regulation and the output gap. The effect of the benefit replacement rate is still negative, but it is no longer significant. For employment protection legislation we now obtain a significant positive effect. Given that the wage coordination index ranges between 1 and 5, our results in column (2) no

longer reveal a U-shaped pattern, but a positive relationship between wage bargaining coordination and employment. This result would confirm earlier findings by see e.g. Bruno and Sachs (1985), Nickell (1997) and Nickell et al. (2005). Column (3) introduces interaction effects between the labor tax rate and wage bargaining coordination. Both interaction terms are insignificant however. Moreover, their signs are opposed to the hypothesis advanced by Daveri and Tabellini (2000). 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 (4) and (5) present CCEP estimation results. Only the output gap, the benefit replacement rate and union density obtain significant coefficients with the expected sign. Other variables are insignificant or obtain the wrong sign. Moreover, the results are again spurious. All in all, the institutions view seems unable to capture the permanent movements in the employment rate in hours. Our results here tend to confirm earlier findings by Ohanian et al. (2008).

5.2. Fiscal policy

Columns (1) and (2) in Table 4 test the fiscal policy model. 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 differences are that we also include the government's financial balance and that we have further split up government consumption in a wage and a non-wage component. In our specification we do not control for smaller categories like property income paid and received by the government and transfers other than social benefits (e.g. transfers to other countries). Our estimated parameters therefore show the effect of a change in one of the included fiscal variables financed by a change in these omitted categories. In column (2) we extend the set of explanatory variables by a number of interaction terms. We interact the labor tax rate with four expenditure variables as a share of total expenditures: social security benefits, productive spending, wage consumption and non-wage consumption. By including these, we test the hypothesis that changes in labor 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[2]. Our results in column (2) reveal the significance of some of these interaction effects. Table 5 exploits these interactions and reports computed fiscal policy effects on the employment rate in hours for two European country groups and the US in 1990-2007. We also report labor tax effects for other periods.

[2] We have added four similar interaction terms with the consumption tax rate, but empirically all these showed up insignificant.

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

	(1)	(2)	(3)
Estimation method	CCEP (a)	CCEP (a)	CCEP (a)
Estimation period	1970-2007	1970-2007	1970-2005
Labor tax rate	-0.116 **	0.123	0.874
Benefit replacement rate	-0.024	-0.036	-0.064
Consumption tax rate	-0.097	-0.186 **	0.001
Capital tax rate	0.014	0.026	-0.007
Social benefit spending in percent of GDP	-0.379 **	-0.703 **	-0.848 **
Productive government spending in percent of GDP	0.061	-0.010	0.007
Government wage consumption in percent of GDP	0.362 **	0.388 **	0.252
Government non-wage consumption in percent of GDP	0.307 *	0.581 **	0.797 **
Government balance in percent of GDP	0.113 **	0.083 *	-0.003
Output gap	0.272 **	0.164 **	0.188 **
Interaction terms			
Labor tax rate x social benefits in percent of total expenditures	-	-0.003	-0.002
Labor tax rate x productive government spending in percent of total expenditures	-	0.012 *	0.013
Labor tax rate x gov. wage consumption in percent of total expenditures	-	-0.006	-0.030 *
Labor tax rate x non-wage consumption in percent of total expenditures		-0.021 **	-0.040 **
Union density rate	-	-	-0.276 **
Employment protection legislation	-	-	0.196
Product market regulation	-	-	0.488
Wage bargaining coordination	-	-	0.066
Wage bargaining coordination squared	-	-	-0.110
Interaction terms			
Labor tax rate x wage bargaining coordination	-	-	0.030
Labor tax rate x wage bargaining coordination squared	-	-	-0.001
DIAGNOSTICS			
R^2 (within)	0.977	0.986	0.996
Bootstrapped MW-EG cointegration test p-value (b)	0.011	0.027	0.019
N.Observations (countries) (c)	600 (19)	600 (19)	532 (18)

Notes:
(a) including country-specific fixed effects and country-specific time trends and allowing for an AR(1) process in the residuals;
(b) the null hypothesis is no cointegration;
(c) Australia is missing in each column due to lack of data on the components of government consumption (wage / non-wage). Greece is missing in column (3) due to lack of data for wage bargaining coordination.

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

Table 5. Fiscal policy effects on the employment rate in hours (effects in percentage points) [(a)]

Fiscal policy effects from Table 4, column (2), 1990-2007	euro area 6	nordic 4	US
Effect of 1 %-point increase in labor tax rate	-0.237 **	-0.112 *	-0.049
Effect of 1 %-point increase in the consumption tax rate	-0.186 **	-0.186 **	-0.186 **
Effect of 1 %-point increase in the capital tax rate	0.026	0.026	0.026
Effect of 1 %-point increase in productive gov. spending / GDP	0.899 *	0.880 *	0.766 *
Effect of 1 %-point increase in wage consumption / GDP	-0.073	-0.064	-0.006
Effect of 1 %-point increase in non-wage consumption / GDP	-1.023 *	-0.990 *	-0.788
Effect of 1 %-point increase in social expenditures / GDP	-0.919 *	-0.915 *	-0.887 *
Fiscal policy effects from Table 4, column (2), other periods			
Effect of 1 %-point increase in the labor tax rate, 1970-1980	-0.102 *	-0.022	0.025
Effect of 1 %-point increase in the labor tax rate, 1980-1990	-0.158 **	-0.083	-0.032
Effect of 1 %-point increase in the labor tax rate, 2003-2007	-0.281 **	-0.145 **	-0.061

Notes:
(a) The results shown in this Table have been computed using the estimated parameters in column (2) of Table 4 and, except for the bottom row, actual data for fiscal policy in 1990-2007 (see Appendix 3). The bottom rows rely on data for 1970-80, 1980-90 and 2003-07.
**: statistically significant at 5%; *: statistically significant at 10%.

The estimation results in both columns (1) and (2) reveal a cointegrating relationship. Concentrating on column (2) and Table 5, we observe significant negative effects from labor and consumption taxes, social security transfers in general, and non-wage consumption. We observe significant positive effects from productive expenditures and from the government's financial balance (surplus). Note though that the effects from labor taxes and non-wage consumption are significant only in the European country groups. They are not significant in the US. The effects of wage consumption and capital taxes are insignificant and close to zero overall. The negative effects of labor taxes, consumption taxes and social transfers, and the positive effects of productive expenditures, confirm the theory discussed in Section 2.2. Finding the weakest effect on employment, or even no effect, from capital taxes is in line with theory also. Negative effects from government consumption are in line with the model developed by Rogerson (2007) if it can be assumed that higher consumption is financed from resources that do not affect workers' permanent income and if households consider the consumption goods provided by the government to be useful. Our specification of the employment equation, which controls for all major financing components affecting workers, contributes to the validity of the first assumption. An increase of useful government consumption then raises household wealth, which may bring down their labor supply. Smaller or even zero effects from wage consumption may follow if households consider goods provided by government employees to be of less or no value. Military expenditures are often thought to be a good example (Rogerson, 2007)[3]. Additional regression results (not shown) are fully consistent with this interpretation. When we do not control for social benefit spending in the regression, and therefore include these benefits among the financing

[3] We remind that government consumption is defined net of education expenditures.

categories, we find a small, insignificant negative effect from non-wage consumption and a positive effect from wage consumption.

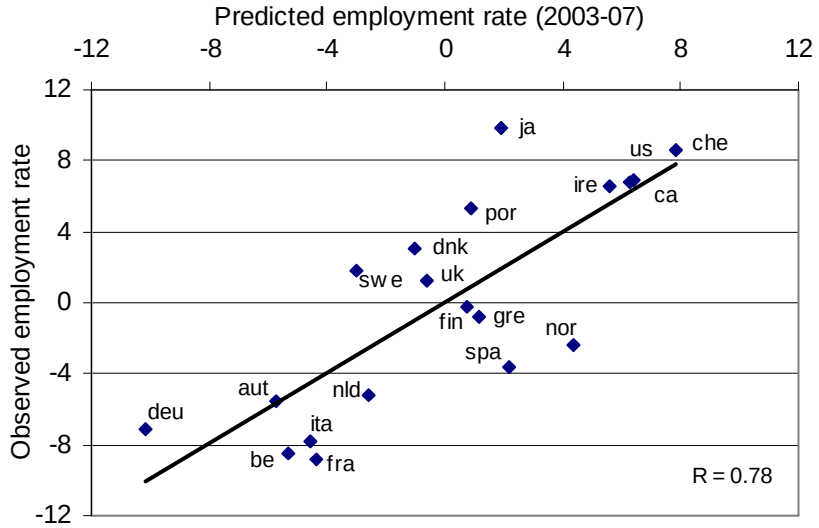
Our results in Table 4 (column 2) and Table 5 help us to understand important labor market facts and developments in the OECD during the last decades. In what follows we discuss the explanatory power of our estimated fiscal model, the estimated effect of fiscal variables (mainly labor taxes) and the estimated size of the employment effects of changes in fiscal policy since the 1970s. In our discussion we will refer to key differences in fiscal policy variables across major countries and country groups. We summarize the underlying data in Appendix 3.

First of all, Figure 2 demonstrates the capacity of our fiscal model to explain the variation of employment in hours across countries and over time. We use the regression result in column (2). The upper panel A of Figure 2 relates our models' prediction (economic explanation) for the *level* of the employment rate in hours in 2003-07 to the true observation. Both prediction and true observation are represented as deviations from their overall country averages. The lower panel B relates predicted and observed *changes* in the employment rate between 1982/83 and 2003/07. 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 panel A is 0.78. Our model correctly predicts the lowest employment rates in 2003-07 in the core countries of the euro area. High labor taxes, low productive expenditures and among the highest social security transfers and non-wage expenditures explain relatively weak employment. Our model also correctly predicts the highest employment rates in countries like the US and Switzerland. Low tax rates, intermediate productive expenditures and (mainly in the US) low social security transfers are important drivers of this result. The Nordic countries combine high taxes and social security transfers with high productive expenditures and government wage consumption. This combination explains their intermediate employment position. Correlation in panel B is close to 0.60. The fiscal model explains employment changes fairly well, at least for the last 25 years. It correctly predicts the relatively poor evolution in countries like Sweden, Finland and Japan, and the relatively strong performance of countries like Ireland, the Netherlands and the US. 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), other factors were dominant.

When it comes to the size of fiscal policy effects, most attention has been paid in the literature to the effects of labor taxes. Our estimated effects in Table 5, especially for the core euro area, are at the upper range of the medium-sized estimates to which we have referred above (e.g. Elmeskov et al., 1998; Nickell et al., 2005; Planas et al., 2007; Estevão, 2007; Berger and Everaert, 2010). They are much lower however than the effects reported by Daveri and Tabellini (2000) and Prescott (2004). As another contribution to this literature, our results offer a new explanation for

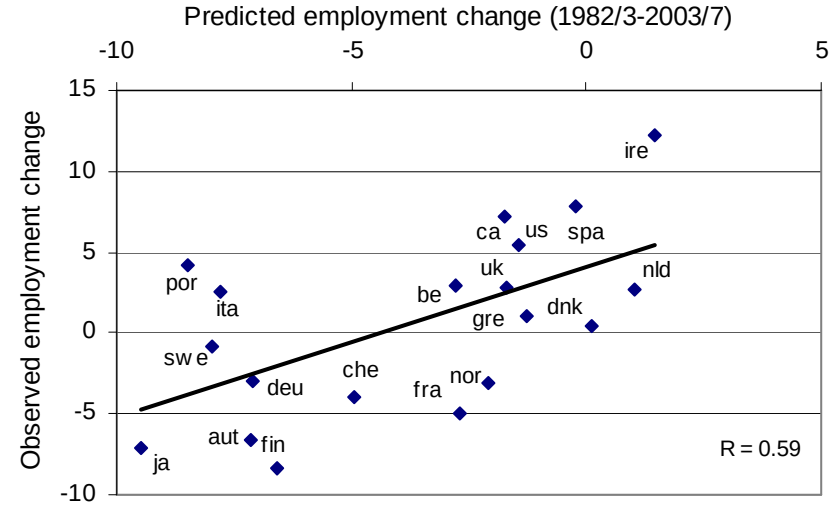
Figure 2. Actual and predicted employment in the fiscal policy model (Table 4, column 2)

2A. Predicted and observed employment levels, 2003-07.
(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).

2B. Predicted and observed changes, 1982/3-2003/7



Note: Germany (deu, 1992-2003/7), Switzerland (che, 1990-2003/7)

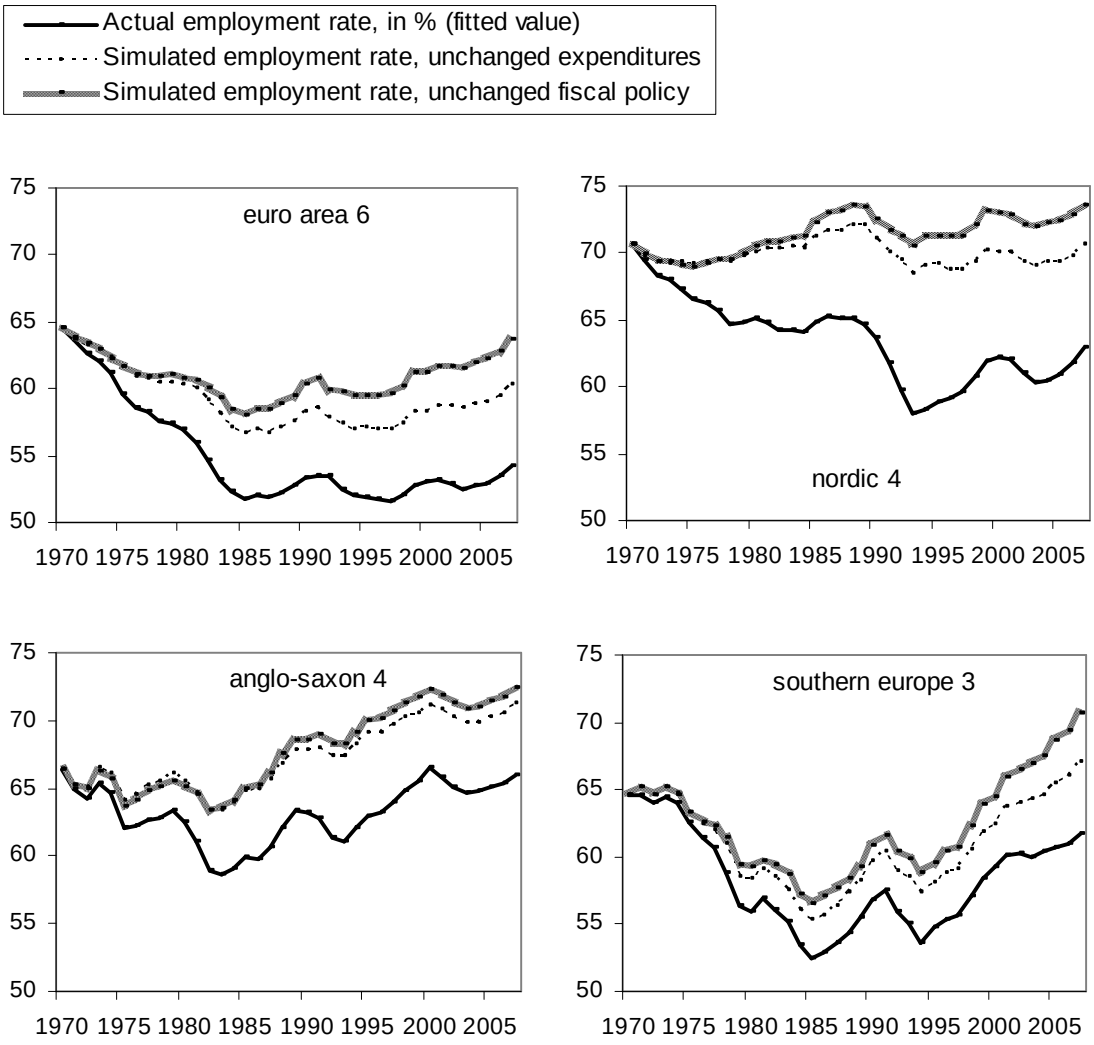
the earlier findings by Daveri and Tabellini (2000) and Berger and Everaert (2010). These authors show that labor taxes have an adverse effect on (un)employment only in continental European countries. They find no effect in Anglo-Saxon and Nordic countries. Their explanation is related to wage bargaining institutions. We confirm in Table 5 Daveri and Tabellini's cross-country differences. However, from our results, it seems clear that the reason for these cross-country differences is the composition of government expenditures, rather than labor 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 core euro area countries also have a higher share of non-wage versus wage consumption than the other countries. A similar analysis in Table 5 for the effects of government expenditures on employment shows much less variation across countries. Next to cross-country differences, our results also reveal time-variation in the labor tax effect. The bottom rows of Table 5 show in all country groups – and most so in the core euro area - a gradual increase in the size of the adverse tax effect over time. Changes in the structure of government expenditures in the direction of a larger share of social benefits and a smaller share of productive expenditures in all country groups explain this evolution. Data for the core euro area countries also show a gradual rise of the share of non-wage consumption, net of education.

Figure 3 reveals the size of the estimated employment effects of changes in fiscal policy variables since 1970 in four country groups. Each graph compares the model's fitted value with (i) the simulated value if all government expenditure variables had remained at their 1970 level, and (ii) the simulated value if all expenditure and all tax variables had remained at their 1970 level[4]. For individual country graphs we refer to Appendix 4. The graphs underscore the major impact of fiscal policy on employment during the last decades, especially in Europe. Fiscal policy changes explain the whole fall in the employment rate in hours in the Nordic countries. These countries show among the strongest increases of labor and consumption tax rates and among the strongest increase in social benefit expenditures since the 1970s. Data also reveal a strong drop in the share of productive expenditures in the 1970s. Fiscal policy changes explain a large fraction of the employment decline in the core euro area in the 1970s, but not the total decline. However, with unchanged expenditures (in percent of GDP) and unchanged tax rates, the employment rate in the core euro area would now be about the same as in 1970. Fiscal policy changes explain only a limited fraction of the fall in employment in the 1970s in the Southern European countries. Unchanged fiscal policy would now in these countries imply employment to be higher than in 1970. The smaller contribution of fiscal changes for the evolution of employment in many countries in the 1970s is clearly consistent with our findings for this period when constructing Figure 2B.

[4] Nickell et al. (2005) present similar results showing the role of institutions. In contrast to these authors we do not include graphs comparing fitted to actual values of the dependent variable. The reason is that for all individual countries in our sample except Norway, the estimated regression in Table 4, column (2), yields an R^2 above 0.965. For Norway the R^2 is 0.94. Both fitted and simulated values in Figure 3 assume an output gap equal to zero.

A comparison of both simulated employment series in each panel of Figure 3 reveals the major role of the expenditure side of fiscal policy. In each country group at least one half to two thirds of the impact of fiscal policy is related to changes in the level and/or structure of expenditures. The role of labor, consumption and capital tax changes is particularly small in the Anglo-Saxon countries. These findings are obviously consistent with the observation of relatively small tax coefficients in the underlying regression (Table 5). Our findings confirm earlier arguments about the importance of the expenditure side for European employment made by Ljungqvist and Sargent (2006), Rogerson (2007) and Dhont and Heylen (2008).

Figure 3. Fitted and simulated model with fiscal policy fixed (Table 4, column 2)



Note:
Fitted employment in this graph is the prediction of the estimated regression equation in column (2), Table 4, including explanatory fiscal variables, country-specific fixed effect, country-specific time trend and the country-specific approximation for the unobserved common factors in Equation (2). The output gap has been assumed equal to zero. Simulated series also assume the output gap equal to zero. The composition of each group is the same as in Figure 1, except for the Anglo-Saxon group. Australia is not included.

5.3. Further discussion and robustness

We have run a series of additional regressions. To test robustness we have first dropped individual countries, and slightly changed the definition of productive expenditures. Next, we have extended the fiscal policy model with labor and product market institutions. A last series of regressions distinguish between the intensive and extensive margins in the employment rate in hours. The effects of taxes and expenditure variables may be different on these two margins. We now discuss the results.

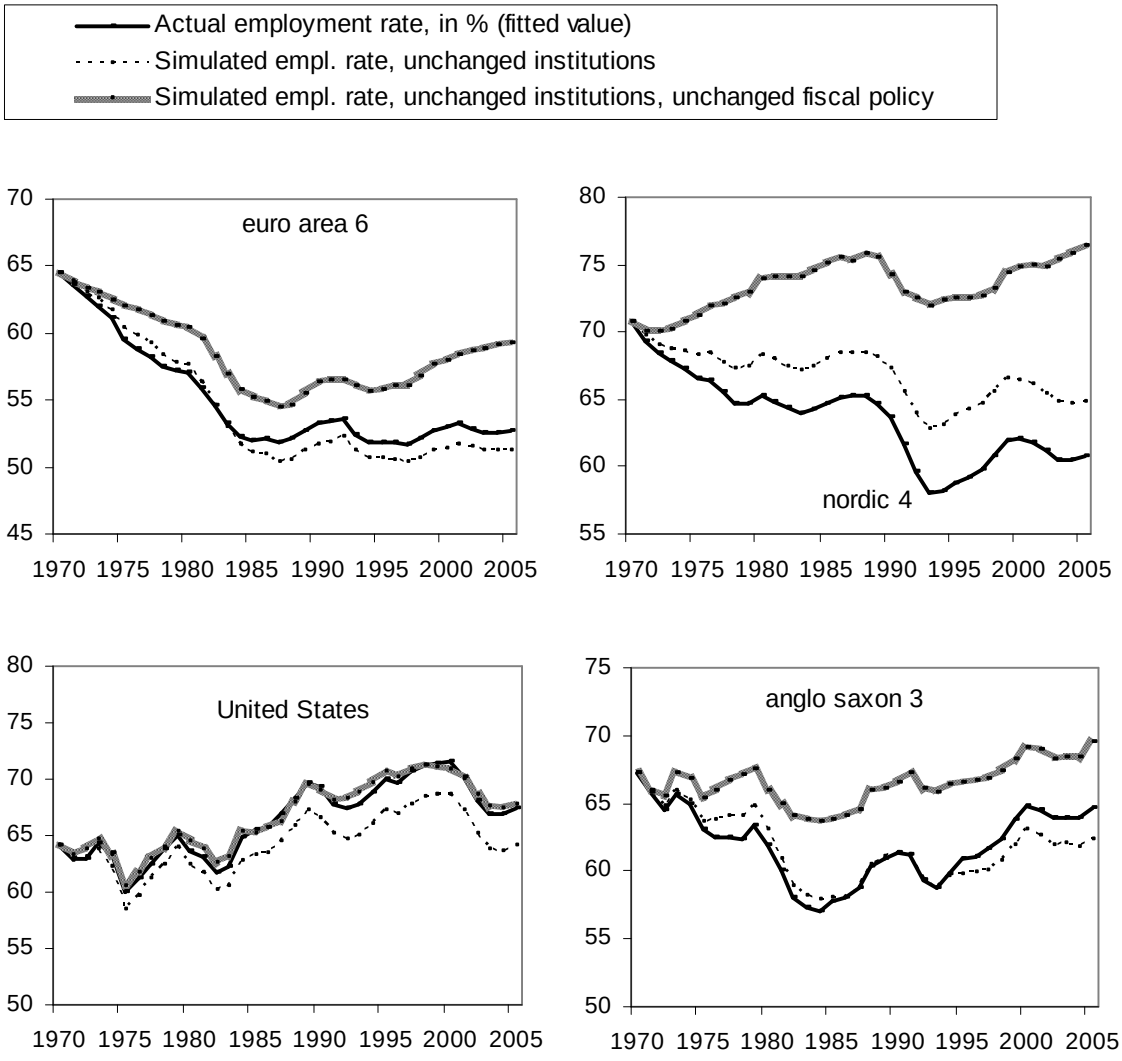
Robustness tests reveal that our findings in Table 4, column (2), do not depend on individual countries being included or not included in the regression. Dropping individual countries does not affect our findings. Neither does a slight change in the definition of productive expenditures. If we exclude government financed R&D, for which data is less frequently available (see Appendix 2), our main results remain unchanged.

Column (3) in Table 4 adds institutional variables to the fiscal model in column (2). With the exception of the union density rate, none of the added institutional variables are statistically significant. Moreover, most of them get the wrong sign. Basically, this result confirms our earlier findings in Table 3, where among the institutional variables only the union density rate always obtained the expected (and significant negative) sign. Its estimated coefficient in Table 4 is quite close to the estimated coefficients in the CCEP regressions in Table 3. The sign and size of the effect of most fiscal variables is not strongly affected when we add institutional variables in column (3). Exceptions are the consumption tax rate and the government's financial balance. Extension with institutional variables does, however, bring about a decline of statistical significance for most fiscal variables. Given that the added institutional variables bring little additional explanatory power, and that there is some degree of correlation between some institutional and fiscal variables, an overall rise of estimated standard errors and p-values comes at no surprise.

Figure 4 shows the relative importance of fiscal variables versus labor and product market institutions for the evolution of employment in two European country groups, the US and an average for three other Anglo-Saxon countries. By analogy with Figure 3, each panel again compares the model's fitted value with two simulated series. The dotted curve depicts simulated employment under the assumption that all labor and product market institutions remained the same as in 1970. The bold grey curve shows simulated employment if all institutions and all fiscal variables had remained unchanged. The difference between the dotted and the grey curves indicates the effect of the fiscal variables. Each panel demonstrates that fiscal policy changes had a much larger influence on the employment rate in hours than institutions, which confirms our earlier findings in this paper. Furthermore, we observe that institutional changes cannot be blamed for low employment in the core euro area countries, on the contrary. In contrast to e.g. Nickell et al. (2005), we find that changes in institutions had beneficial effects on actual

employment in these countries, just like in the US[5]. With institutions fixed, employment would have been lower than its actual level. In the Nordic countries we observe the opposite. (Differences in the evolution of union density may explain this). Fixed institutions would have implied higher employment in these countries, although much less so than fixed fiscal policy.

Figure 4. Fitted and simulated model with fiscal policy and institutions fixed (Table 4, column 3)



Note:
Fitted employment in this graph is the prediction of the estimated regression equation in column (3), Table 4, including explanatory fiscal and institutional variables, country-specific fixed effect, country-specific time trend and the country-specific approximation for the unobserved common factors in Equation (2). The output gap has been assumed equal to zero. Simulated series also assume the output gap equal to zero. The Anglo-Saxon group includes Canada, Ireland and the United Kingdom.

[5] For a proper understanding it should however be emphasized that Nickell et al. include labor taxes and unemployment benefits among the institutional variables. They show that these two 'institutions' were even the most influential drivers behind rising unemployment in much of Europe (p. 21 of their paper). This clearly brings their results closer to ours.

In Table 6 we distinguish between the extensive and the intensive margin in hours worked. We use the employment rate in persons and average hours worked per employed person as alternative dependent variables[6]. Columns T3(2) and T3(4) test the institutional model, column T4(2) tests the fiscal model. Column names refer to the corresponding columns in earlier Tables.

Our main findings for the employment rate in hours also hold for the employment rate in persons. Using the fixed effects estimator we obtain in column T3(2) statistically significant and well-signed coefficients for the labor tax rate, the consumption tax rate, union density, product market regulation and the output gap. We also observe a U-shaped relationship between the coordination of wage bargaining and employment, but this is not statistically significant. However, the institutional 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(4). Extending the estimated equations with interaction terms in wage bargaining and the labor tax rate does not change this conclusion. These additional interaction terms are insignificant (regressions not shown). The results from the estimated fiscal model in column T4(2) are more convincing. Here we can again reject the null hypothesis of no cointegration. The results in this column, as well as Table 7, show for employment in persons significant negative effects from labor taxes and consumption taxes and significant positive effects from productive expenditures. We also observe negative effects for social benefit expenditures and public non-wage consumption, but these are not significant at the 10% level (all corresponding p-values are between 11% and 20%). All in all, the size of estimated effects is quite close to our findings for the employment rate in hours. We also observe the same cross-country differences in the labor tax effect. Regression analysis for average hours worked per employed person yields rather weak results. Estimates for the institutional model are again spurious. Estimated effects of the policy variables in the fiscal model are smaller than what we observe for the employment rate in persons, although the sign of effects is generally the same. It seems clear from our results in Tables 6 and 7 that the effects that we observed in earlier sections mainly operate along the extensive margin. In this respect our results are fully in line with recent work by e.g. Langot and Quintero-Rojas (2008).

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 labor 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 labor 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 1970-2007.

[6] The employment rate in persons is in percent of population at working age (15-64). Hours worked per employed person are in percent of 1920. We assume that a full-time worker potentially supplies 1920 hours per year, i.e. 40 hours per week times 48 weeks. See also Appendix 2.

Table 6. Empirical results for the *employment rate in persons* and *hours worked per employed* (°)

Dependent variable	Employment rate in persons			Hours worked per employed		
	T3(2)	T3(4)	T4(2)	T3(2)	T3(4)	T4(2)
Estimation method	Fixed effects (a)	CCEP (b)	CCEP (b)	Fixed effects (a)	CCEP (b)	CCEP (b)
Estimation period	1970-2005	1970-2005	1970-2007	1970-2005	1970-2005	1970-2007
Labor tax rate	-0.438**	-0.081*	0.099	-0.010	-0.003	0.303
Benefit replacement rate	0.072**	0.013	0.004	-0.124**	-0.168**	-0.059 *
Consumption tax rate	-0.238**	0.022	-0.141**	0.251**	0.079	0.022
Union density rate	-0.134**	-0.174**	-	-0.014	-0.055	-
Employment protection legislation	3.351**	1.132**	-	-1.820**	-0.514	-
Product market regulation	-1.422**	-0.082	-	-0.541**	0.162	-
Wage bargaining coordination	-0.268	-0.090	-	2.242**	-0.446	-
Wage bargaining coordination squared	0.060	-0.010	-	-0.286**	0.064	-
Capital tax rate	-	-	0.028*	-	-	-0.008
Social benefit spending in percent of GDP	-	-	-0.523**	-	-	-0.184
Productive government spending in percent of GDP	-	-	0.098	-	-	-0.049
Government wage consumption in percent of GDP	-	-	0.356**	-	-	0.146
Government non-wage consumption in percent of GDP	-	-	0.477**	-	-	0.213
Government balance in percent of GDP	-	-	0.088**	-	-	0.025
Output gap	0.411**	0.307**	0.174**	0.251**	0.137**	0.068
Interaction terms						
Labor tax rate x social benefits in percent of total expenditures	-	-	-0.002	-	-	-0.009
Labor tax rate x productive government spending in percent of total expenditures	-	-	0.011**	-	-	0.004
Labor tax rate x gov. wage consumption in percent of total expenditures	-	-	-0.006	-	-	-0.006
Labor tax rate x non-wage consumption in percent of total expenditures	-	-	-0.016**	-	-	-0.009
DIAGNOSTICS						
R^2 (within)	0.791	0.906	0.989	0.902	0.981	0.986
Bootstrapped MW-EG cointegration test p-value (c)	0.312	0.250	0.040	0.585	0.110	0.050
N.Observations (countries) (d)	605(19)	548(19)	600(19)	605(19)	548(19)	600(19)

Notes: (°) column numbers are those of the correspo nding 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.

(d) see corresponding columns in Tables 3 and 4.

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

Table 7. Fiscal policy effects on the employment rate in persons (effects in percentage points) [(a)]

Fiscal policy effects from Table 6, column T4(2), 1990-2007	euro area 6	Nordic 4	US
Effect of 1 %-point increase in the labor tax rate	-0.183 **	-0.084	-0.020
Effect of 1 %-point increase in the consumption tax rate	-0.141 **	-0.141 **	-0.141 **
Effect of 1 %-point increase in productive gov. spending / GDP	0.957 **	0.939 **	0.831 **
Effect of 1 %-point increase in wage consumption / GDP	-0.094	-0.085	-0.028
Effect of 1 %-point increase in non-wage consumption / GDP	-0.805	-0.779	-0.618
Effect of 1 %-point increase in social expenditures / GDP	-0.715	-0.711	-0.687
Fiscal policy effects from Table 6, column T4(2), other periods			
Effect of 1 %-point increase in the labor tax rate, 1970-1980	-0.067	-0.002	0.055
Effect of 1 %-point increase in the labor tax rate, 1980-1990	-0.118 **	-0.061	0.000
Effect of 1 %-point increase in the labor tax rate, 2003-2007	-0.218 **	-0.110 *	-0.030

Notes:
(a) The results shown in this Table have been computed using the estimated parameters for column T4(2) of Table 6 and, except for the bottom row, actual data for fiscal policy in 1990-2007 (see Appendix 3). The bottom row relies on data for other periods.
**: statistically significant at 5%; *: statistically significant at 10%.

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 labor studies.

Our results support the fiscal view. We find that hours worked fall when labor taxes, consumption taxes and social benefit expenditures are increased, and when productive government expenditures are reduced. A shift from public wage to non-wage consumption expenditures (net of education) also goes along with lower employment. We find no significant effect from capital taxes. Further analysis reveals that most of these effects operate along the extensive margin in aggregate hours worked. 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 the early 1980s. Differences in (the evolution of) labor 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 labor 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.

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 labor, and to raise the share of productive government expenditures.

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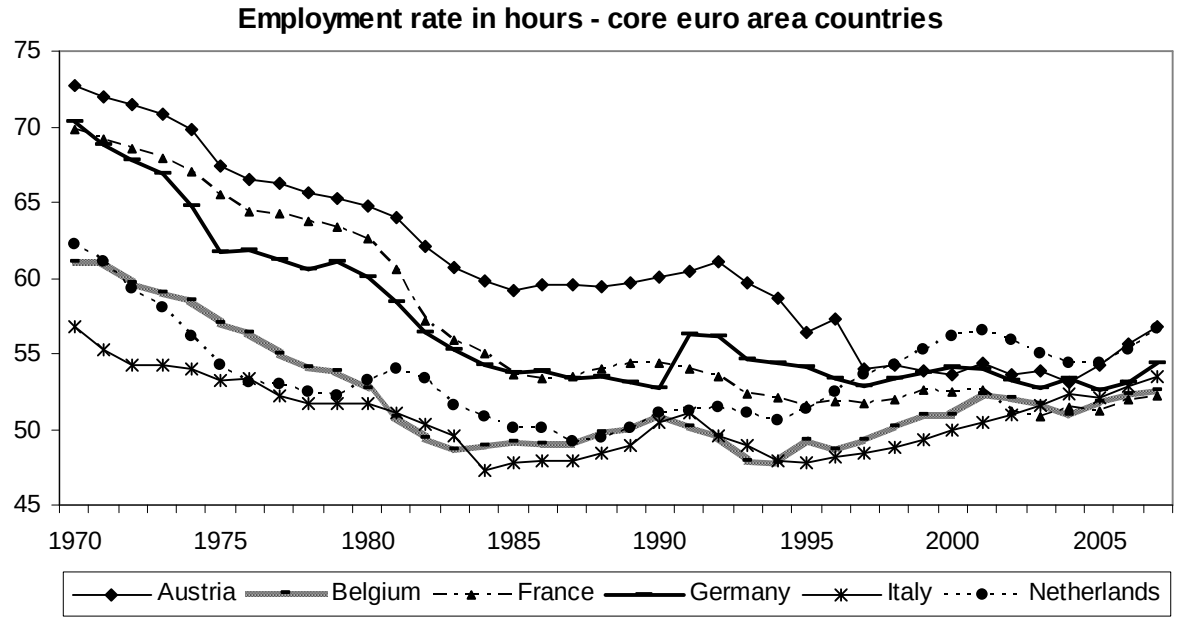
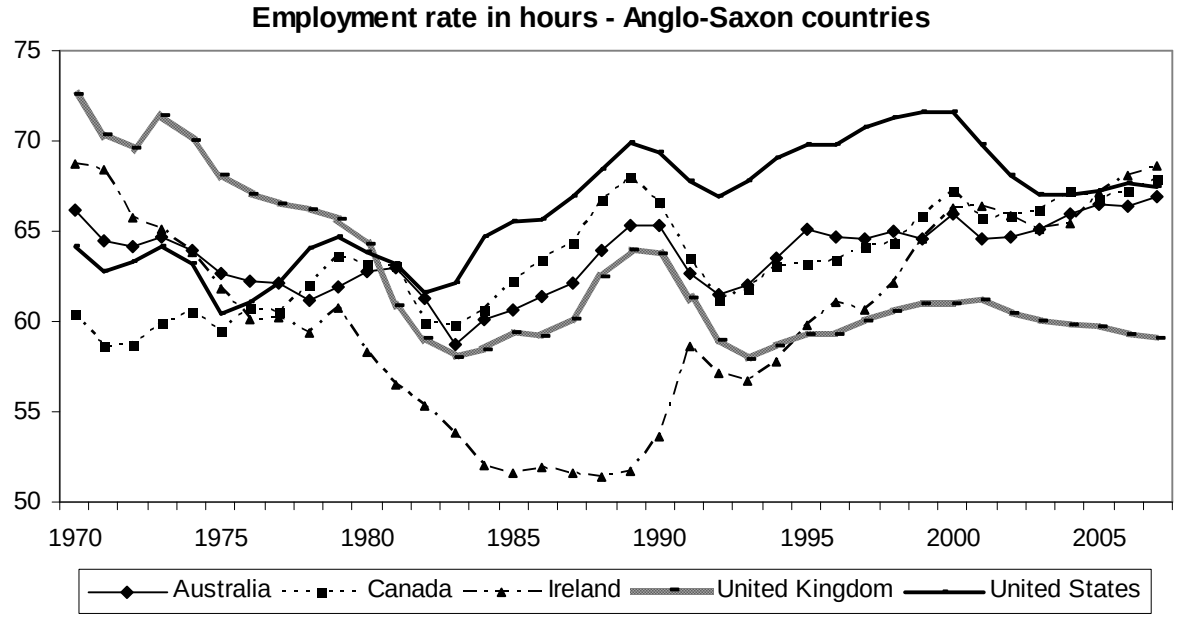
Appendix 1. Employment rate in hours in individual countries, in %, 1970-2007






Employment rate in hours - Nordic countries
80
75
70
65
60
55
50
1970
1975
1980
1985
1990
1995
2000
2005
Denmark
Finland
Norway
Sweden


Employment rate in hours - other countries
85
80
75
70
65
60
55
50
45
40
1970
1975
1980
1985
1990
1995
2000
2005
Greece
Portugal
Spain
Switzerland
Japan

Appendix 2. Data description and sources

Almost all data that we use in this paper are publicly available from OECD sources and from The Conference Board and Groningen Growth and Development Centre. We downloaded OECD data in March/April 2010. From the Conference Board we use the Total Economy Database, version June 2009. Details are described now.

Employment and hours worked:
Definitions: The *employment rate in persons* indicates the number of people with a job (*L*) in percent of population at working age (*N*). The *employment rate in hours* indicates the fraction of 'potential' hours that is actually being worked in an economy. It is calculated as aggregate hours worked divided by 1920 times population at working age (*hL/(1920.N)*). Our measure for *hours per employed* (*h*) is average annual hours worked per employed person. We assume that a full-time worker potentially supplies 1920 hours per year, i.e. 40 hours per week times 48 weeks.
Sources: *L*, *h*: The Conference Board and Groningen Growth and Development Centre, Total Economy Database, June 2009; *N*: OECD Stat, Annual Labour Force Statistics.
Data adjustments: The data for average annual hours worked per employed person show a break in the series in Portugal in 2000. From 2000 onwards we therefore use data from OECD Stat, Labour Force Statistics, Hours worked. Conference Board data and OECD data for Portugal in the 1990s are exactly the same (1994-1999) or show a difference smaller than 1.5% (1991-93).

Labor tax rate:
Definition: Implicit labor tax rate, in percent of labor cost.
Calculated as the sum of non-wage labor costs *and* personal income tax revenues attributable to labor income, in percent of total labor 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. Using comparable OECD data we have (i) calculated the same series for Australia, Canada, Norway and Switzerland, which are not included in Martinez-Mongay's dataset, and (ii) extended the data until 2007 for all other countries. Correlation between the labor 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 1971 only for Denmark, 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 6 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. We have added these data 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, government fixed capital formation and government financed R&D, 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 1998-2006 have been taken from OECD, Education at a Glance, 2001-2009. For 2007 we relied on data in OECD Stat, National Accounts, General Government Accounts (Government Expenditures by Function). Data for nominal GDP, nominal government fixed capital formation and government financed R&D have been taken from OECD, Statistical Compendium, Economic Outlook (series GDP, IGAA) and Main Science and Technology Statistics (series G_FGXG).
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. OECD data for government financed R&D (by far the smallest component) are not available in 1970-1980. We have assumed them equal to their level in % of GDP in 1981. Missing data for individual years after 1980 have been calculated by interpolation. As we mention in the main text we have computed a second series for productive government expenditures including only education and fixed investment.
Data shortages: Data are available since 1971 only for Denmark, since 1977 only for Portugal, since 1990 only for Switzerland and since 1993 only for Germany.

Government wage consumption in percent of GDP
Calculated as total government final wage consumption, diminished with the fraction of public education outlays going to wages (compensation of employees). We subtract wages in education since in our empirical model all education expenditures are part of productive expenditures. Due to lack of sufficient data over time, we assume the fraction of wages in education constant per country and equal to the average of available data in 1995-2007.

Sources: Total final wage consumption and GDP: OECD, Statistical Compendium, Economic Outlook (series CGW, GDP). The data for the fraction of education expenditures going to wages can be computed from OECD.Stat, National Accounts, General Government Accounts (Government Expenditures by Function). Data are only available since 1995.
Data shortages and adjustments: Data for government wage consumption are not available for Australia. They are available since 1971 only for Denmark, since 1976 only for Belgium, since 1977 only for Portugal, since 1990 only for Switzerland and since 1993 only for Germany. We have taken data for Belgium in 1970-84 from national sources (Belgostat). Data for the fraction of wages in public education outlays are not available for Switzerland. We have assumed this fraction for Switzerland equal to the average over all countries (63%), which is also the fraction in neighboring Germany.

Government non-wage consumption in percent of GDP
Calculated as total government final non-wage consumption, diminished with the fraction of non-wage consumption expenditures in public education. OECD data for final non-wage consumption include non-wage consumption in education. We subtract the latter since in our empirical model all education expenditures are part of productive expenditures. Due to lack of sufficient data over time, we assume the fraction of non-wage consumption in education constant per country and equal to the average of available data in 1995-2007.
Sources: Total final non-wage consumption and GDP: OECD, Statistical Compendium, Economic Outlook (series CGNW, GDP); Education expenditures going to non-wage consumption: OECD.Stat, National Accounts, General Government Accounts (Government Expenditures by Function). Data are only available since 1995.
Data shortages: see wage consumption.

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)
Data shortages: Data are available since 1971 only for Denmark, since 1977 only for Portugal, since 1990 only for Switzerland and since 1993 only for Germany.

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 labor tax rate. This trend better reflects the structural composition of government spending.

Government financial balance in percent of GDP
Source: OECD, Statistical Compendium, Economic Outlook (series NLGQ)
Data shortages: Data are available since 1971 only for Denmark, since 1977 only for Portugal, since 1978 only for France, since 1990 only for Switzerland and since 1993 only for Germany.

Output gap
Source: OECD, Statistical Compendium, Economic Outlook (series GAP)

Data shortages: Data are missing for several countries in the early 1970s (Denmark, Finland, France, Ireland, Norway, Portugal, Spain, United Kingdom). Data are available since 1990 only for Switzerland and since 1993 only for Germany

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 1985-2007. 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). This procedure does not work for Portugal in 1970-74 and for Greece, for which Nickell and Nunziata (2001) have no data. For Greece in 1980-84 we use and interpolate data from OECD Statistical Compendium (Labor Market and Social Issues Database).

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 Greece in 1970-76, Portugal in 1970-75 and Switzerland in 1970-75 have been obtained by backward extrapolation using administrative trade union density data from OECD Statistical Compendium (Labor 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.

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. We assume that they remain unchanged at the level of 2003.

Coordination of Wage Bargaining:
Definition: Index from 1 to 5 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; 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; 3 = Industry-level bargaining with somewhat irregular and uncertain pattern-setting and only moderate union concentration; Government wage arbitration; 4 = Centralized bargaining by peak confederation(s) or government imposition of a wage schedule/freeze, without a peace obligation; Informal centralization of industry- and firm-level bargaining by peak associations; Extensive, regularized pattern-setting coupled with a high degree of union concentration; 5 = Centralized bargaining by peak confederation(s) or government imposition of a wage schedule/freeze, with a peace obligation; Informal centralization of industry-level bargaining by a powerful, monopolistic union confederation; Extensive, regularized pattern-setting and highly synchronized bargaining coupled with coordination of bargaining by influential large firms.
Source: Kenworthy (2001).
Data shortages and adjustments: 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 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.

Kenworthy data are available only until 2000. We expand these original data until 2005 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.

Reference:

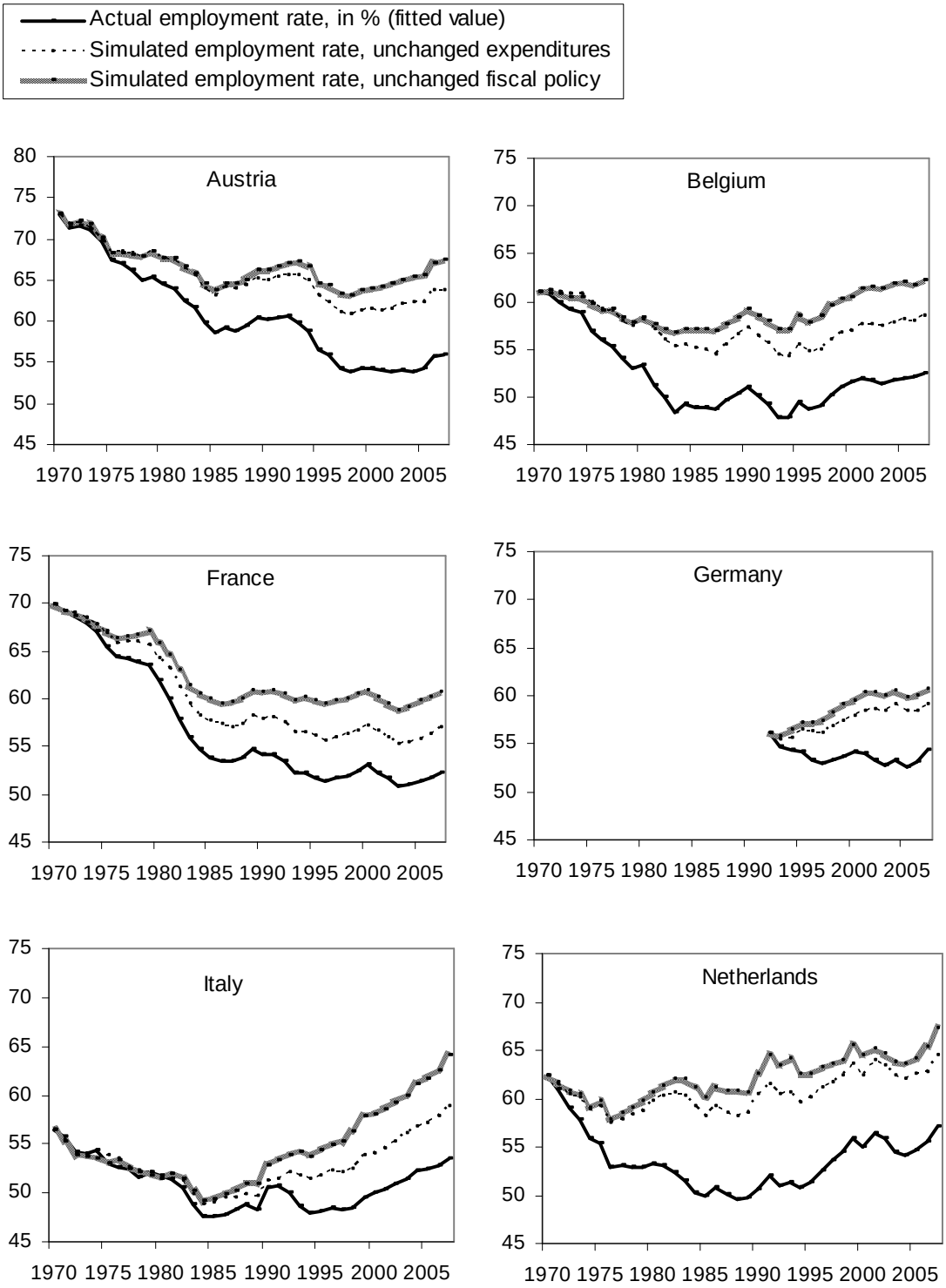
Asplund, R. (2007), Finland: Decentralisation tendencies within a collective wage bargaining system, *ETLA Discussion Papers*, Research Institute of the Finnish Economy, N° 1077.

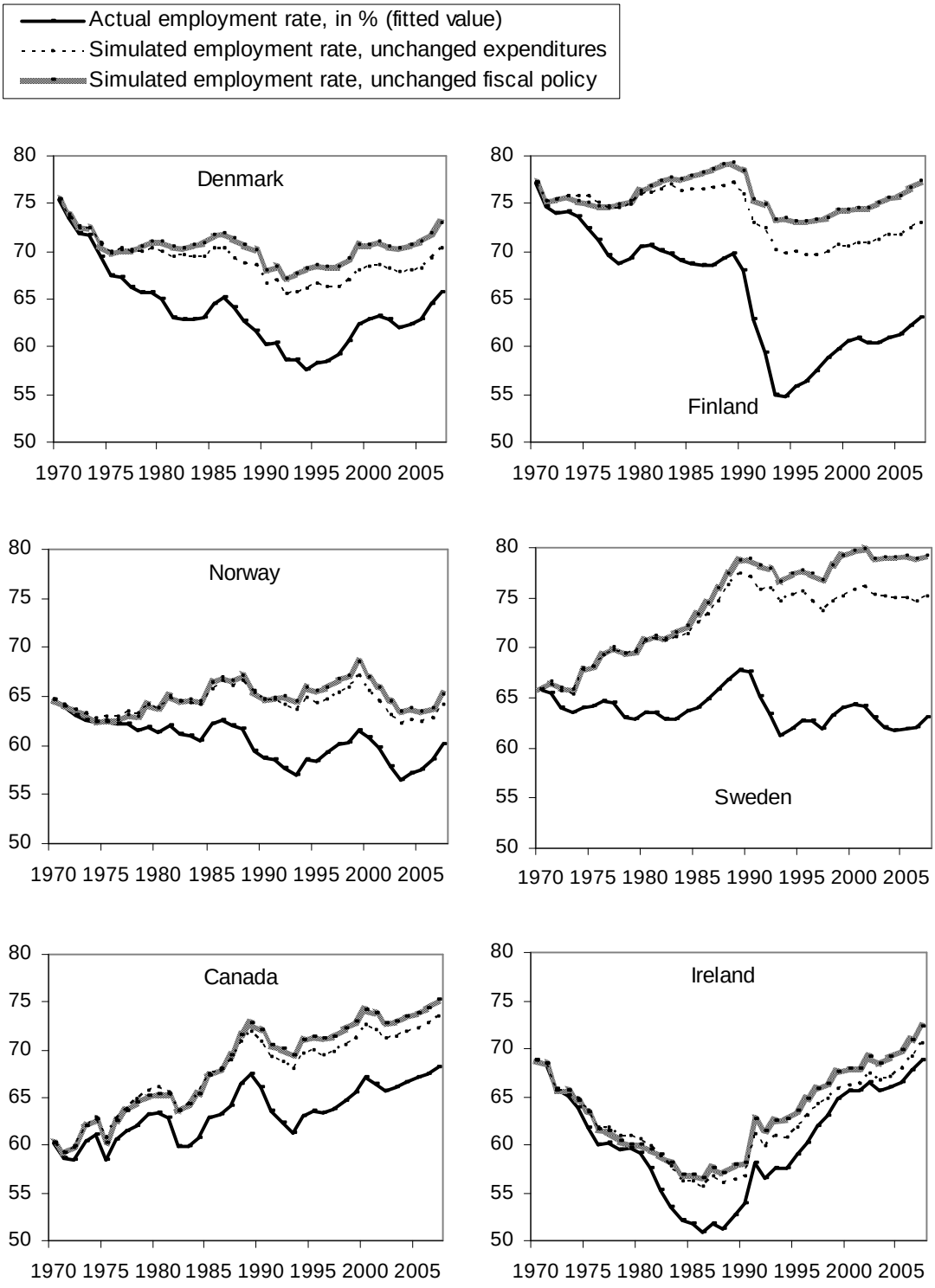
Appendix 3. Fiscal policy data in four country groups

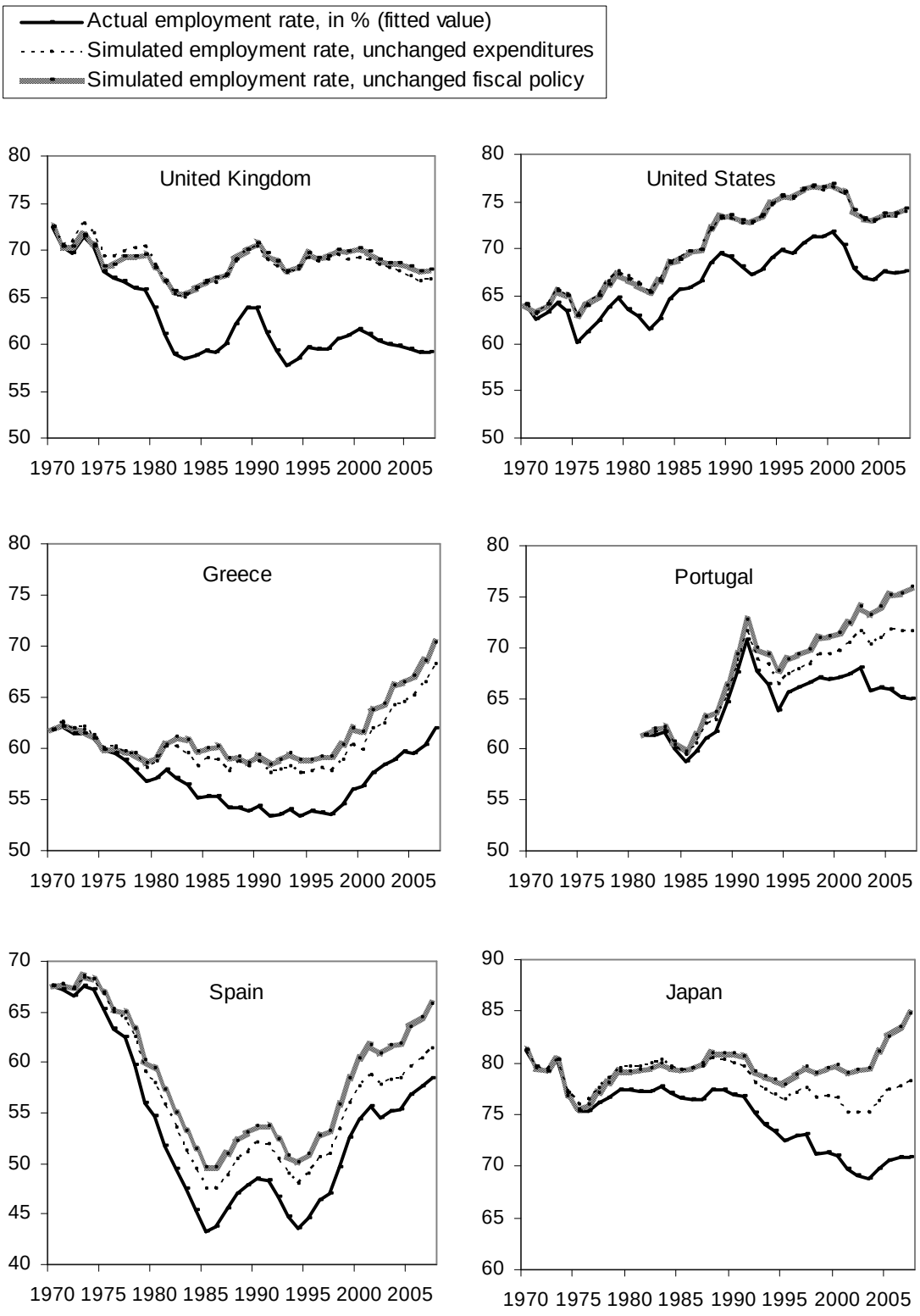
	Labor tax rate (%)	Con-sumption tax rate (%)	Social expenditures in % of total expenditures	Productive government spending in % of total expenditures	Government wage consumption in % of total expenditures	Non-wage consumption in % of total expenditures	Total government expenditures in % of GDP
1990-2007							
Euro area-6	39.6	13.1	33.0	16.5	14.1	18.4	50.7
Nordic-4	41.6	16.2	31.5	20.4	20.9	12.7	54.4
US	24.2	7.2	31.3	25.9	17.8	13.7	36.3
Anglo-S-3	24.1	14.7	28.1	20.2	20.2	16.3	41.5
South.Eur-3	28.3	11.8	30.1	18.9	19.0	11.7	43.5
Euro area 6							
1970-74	29.0	11.4	30.8	24.4	16.9	14.9	40.9
1982-83	37.0	10.4	32.1	19.2	15.8	15.1	54.1
2003-07	39.2	14.0	33.6	16.6	13.5	20.7	49.0
Nordic 4							
1970-74	31.2	13.6	24.1	29.4	23.1	12.4	39.8
1982-83	37.3	13.4	27.6	21.3	23.1	11.6	53.7
2003-07	40.6	16.8	31.4	21.3	21.6	14.7	49.8
US							
1970-74	20.0	9.0	24.8	38.0	20.6	16.6	32.2
1982-83	23.0	7.3	27.7	31.2	18.4	15.5	37.0
2003-07	23.5	6.9	32.9	26.0	17.1	14.3	36.3
Anglo-S-3							
1970-74	16.7	13.7	19.8	27.5	21.1	13.6	41.3
1982-83	23.0	13.3	24.3	20.5	20.7	14.2	50.9
2003-07	23.6	14.3	27.5	21.6	20.9	17.8	39.2
South.Eur-3							
1970-74	14.0	8.7	28.0	20.9	23.2	13.2	24.4
1982-83	21.7	8.7	27.3	17.3	20.2	12.3	37.6
2003-07	30.6	12.3	32.7	19.0	19.5	13.7	43.1

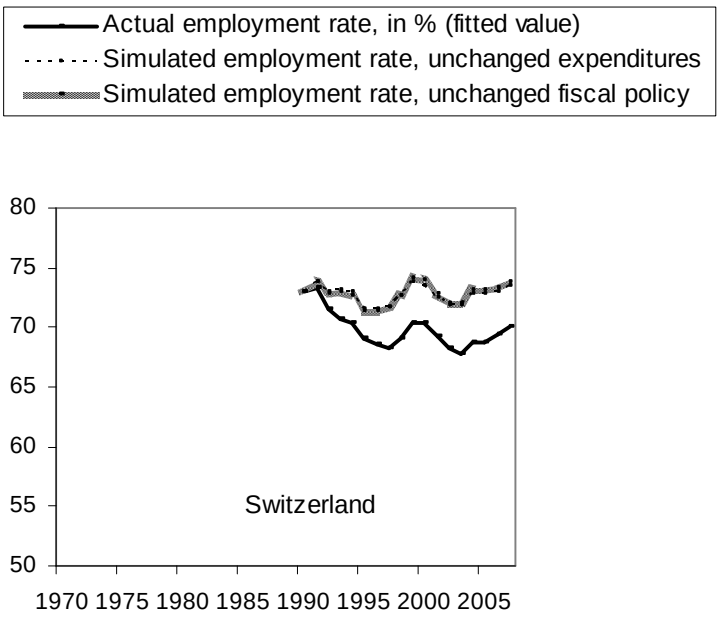
Note: For definitions of country groups, see Figure 1. Anglo-Saxon-3 is UK, Ireland and Canada. Southern Europe-3 is Greece, Portugal and Spain.

Appendix 4. Fitted and simulated model with fiscal policy fixed in individual countries (1970-2007, data derived from Table 4, column 2)




Actual employment rate, in % (fitted value)
Simulated employment rate, unchanged expenditures
Simulated employment rate, unchanged fiscal policy
Denmark
Finland
Norway
Sweden
Canada
Ireland
80
75
70
65
60
55
50
1970 1975 1980 1985 1990 1995 2000 2005


Actual employment rate, in % (fitted value)
Simulated employment rate, unchanged expenditures
Simulated employment rate, unchanged fiscal policy
United Kingdom
United States
Greece
Portugal
Spain
Japan
1970 1975 1980 1985 1990 1995 2000 2005


Actual employment rate, in % (fitted value)
Simulated employment rate, unchanged expenditures
Simulated employment rate, unchanged fiscal policy
80
75
70
65
60
55
50
Switzerland
1970 1975 1980 1985 1990 1995 2000 2005