Unemployment, Taxation and Public Expenditure in Growing Economies*

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Abstract

This paper considers the financing of productive public goods and social benefits through different types of taxes in a growth model with unemployment. We incorporate unemployment, caused by the wage-setting behaviour of a monopolistic union, in a neoclassical growth model which integrates a quite detailed structure of taxes used to finance productive public expenditures and social transfers and parameterizes the inefficiency of government to transform taxes into public goods or transfers. The main conclusion is that the relationship between unemployment and labour taxes critically depends on the structure of public spending, the degree of government efficiency and the unions perception on how wages affect the welfare state. If unions internalize that transfers and social benefits are closely related to labour taxes, they do not pressure for higher wages in response to higher taxes. This result offers an alternative explanation to the lack of a positive correlation between unemployment and labour taxes in most OECD countries and periods, whereas the empirical evidence for 21 OECD countries support the effects on unemployment rates of the interaction between taxes and government efficiency.

Keywords: Unemployment, taxes, monopolistic union.
JEL Classification: H21, E62, J51, O41.

1. Introduction

In recent years the common consensus among economists is that the bad performance of labour markets in many OECD countries from the mid seventies onwards was the result of institutions changes (see, for example, Nickell, 1997, and Nickell, Nunziata and

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Ochel, 2005) and its interaction with shocks (Blanchard and Wolfers, 2000). The institutions usually considered give place to the existence of non-competitive demand and supply functions, implying that some policies have negative effects upon the unemployment rate. Among these institutions, the effects of the tax wedge and its structure have received particular attention.

Although the number of contributions to this question is large, the usual theoretical result (e.g.: Pissarides, 1998, or Daveri and Tabellini, 2000, for a closed economy, or Alesina and Perotti, 1997, in the case of a small open economy) is that higher taxes are translated into higher wages and higher unemployment rates in markets with a non-competitive labour supply. Given this general conclusion, different proposals have emerged about the changes in the tax structure required to promote employment. For example, Kolm (1998) has analyzed the effects of a tax reform in a model in which product markets show different levels of competition. Other authors (for example, Bovenberg and van der Ploeg, 1998, or Koskela et al., 1998) have analyzed the effects of tax reforms that lower the tax burden of labour with increases in taxes on goods and activities which have negative externalities such as, for example, pollution.

However, these contributions present two kinds of objections: one at the empirical level and the other at the theoretical one. As we display in the second section, the empirical evidence shows that the correlation between the unemployment rate and the tax wedge is not very robust neither in time nor in space. At the theoretical level, most of the models used to find a positive correlation between the tax wedge and unemployment neglect the role of taxes to finance social benefits or public goods with productive services.[2] This property of many unemployment models contrasts with the abundant theoretical literature which studies the link between growth and public expenditure, using models in which taxes are used to finance the provision of public goods which enter in the production function or in the utility function. Consequently, the lack of models which integrate these two streams in the literature can limit the scope of some policy recommendations and, at the same time, account for the absence of explanations of some results at the empirical level.

The main contribution of this paper is that it considers explicitly the financing of productive public goods and social benefits through different types of taxes in a growth model with unemployment. The simultaneous consideration of government activities and its financing together with their interactions with labour markets is particularly important to analyze alternative tax reforms. The way we introduce unemployment in a growth model is through the presence of a monopolistic union. Within this model, we conclude that the correlation between the unemployment rate and labour taxes can

[2] An important exception is the contribution of Summers, Gruber and Vergara (1993).

be altered by the public spending structure, by the efficiency of governments to produce public goods and services using different tax resources, and by the way unions internalize taxes and social benefits. Therefore, we generalize some previous results in the literature in a growth model where all decisions by economic agents are taken into account, confirming the findings by Alesina and Perotti (1997), Summers, Gruber and Vergara (1993) or Gruber (1997) that the effects of labour taxes on unemployment may be insignificant if workers internalize the social benefits they are buying with taxes through the provision of public services.

The structure of this paper is the following. In the second section, using a sample of OECD countries we analyze the empirical evidence on the correlation between unemployment and labour taxes, taking as the starting point the results of Daveri and Tabellini (2000). In the third section we present our theoretical model. In the fourth section we calibrate the model and perform some numerical exercises, in order to analyze the relationship between unemployment and labour taxes. Finally, in section five we present the main conclusions of this paper.

2. Empirical evidence in OECD countries.

The argument that higher labour taxes are responsible for higher unemployment rates seems to be very attractive. Besides many theoretical results derived from static models, there is the extended opinion that labour taxes and unemployment rates increased simultaneously during the seventies and eighties, and that European countries showed higher levels of both variables in contrast with other economies such as the United States, where labour taxes and unemployment were lower.

Although the empirical research offers a wide range of results, we can extract some preliminary general conclusions: whereas the cross-section evidence (e.g.: Jackman, Layard and Nickell, 1996, Nickell, 1997 and Nickell and Layard, 1999) shows a null or low correlation between labour taxes and unemployment rates, the time series or panel data correlation (e.g.: Bean, Layard and Nickell, 1986, Tyrväinen, 1995, Elmeskov, Martin and Scarpetta, 1998, Blanchard and Wolfers, 2000 or Nickell, Nunziata and Ochel, 2005) is usually positive and statistically significant.

Without doubt, one of the contributions most favourable to the hypothesis that higher labour taxes cause higher unemployment rates is that of Daveri and Tabellini (2000, DT from now onwards), who analyze both the time-series and cross-section dimensions of this correlation in a sample of OECD countries.[3] Their estimations show that the observed increase in EU labour taxes of 14 points from 1965 to 1995 can explain the

[3] Using a similar framework Kiander, Kilponen and Vilmunen (2000) offer similar results.

augment of 4 points (approximately half of the observed increase) in the unemployment rate. However, DT find that the relationship between both variables is not homogeneous in the sample, depending on the institutions that characterize the wage setting in each country. As we can see in Table 1, there are pronounced differences across countries in union coverage, and union and employer coordination, which are the variables used by DT to classify industrial countries in three different groups: their first sample of countries (EUCON) comprised Germany, Australia, Belgium, Spain, France, Italy and the Netherlands, the second (ANGLO) included the USA, Canada, the UK and Japan, and, finally, the third sample (NORDIC) consisted of Sweden, Norway and Finland. These authors show that in countries with competitive labour markets (as in the USA, Canada or the UK) or with a high degree of centralization in wage bargaining (e.g.: Nordic countries), the effects of labour taxes upon unemployment are insignificant, whereas in continental European countries, with high union coverage and a medium degree of wage bargaining, an increase of 1 point of labour taxes gives place to a rise in the unemployment rate which ranges between 0.29 and 0.54 points.

Panel (a) in Figure 1 presents the pattern of unemployment rates and labour taxes in the three groups of countries.[4] Using the same kind of information we can extend the coverage of the sample for more years and countries.[5] Following DT's criteria, we can use the information in Table 1 about union coverage and the extent of coordination in wage bargaining to include Greece, Switzerland and Portugal in EUCON, Ireland and New Zealand in ANGLO and Austria and Denmark in NORDIC. As we can see in the last column of Table 1 the product of union coverage and union and employer coordination relative to Sweden clearly supports the classification of the new countries in the sample in the three groups considered. If any, the original DT's classification is questionable for Japan (which might be included in EUCON) and Germany, which presents the same relative product as Finland.

As we can see in Figure 1, *EUCON* countries are characterized by an important and steady increase in labour taxes, which doubled between 1960 and 1995, and in the unemployment rate, which went from 2-3 per cent to an average level of 10 per cent at the end of the sample, mainly due to the bad performance of labour markets during the seventies. However, it is important to underline that in the sixties, there were also important increases in labour taxes with no incidence on unemployment. In the *ANGLO* sample, labour taxes also doubled but unemployment rates augmented moder-

[4] The labour tax rates used by Daveri and Tabellini are computed as suggested by Mendoza, Milesi-Ferretti and Asea (1997).

[5] All the data used in the paper is available at iei.uv.es/~rdomenec/DG/DG_2005.htm. The main sources of the data are Nickell, Nunziata and Ochel (2005) and Boscá, García and Taguas (2005).

Table 1
Some labour markets institutional indicators in OECD countries

	DT	Union coverage	Coordination union	Coordination employer	Relative Product	Labour taxes	Government efficiency
ANGLO							
Canada	1	2	1	1	0.07	0.31	1.55
Japan	1	2	2	2	0.30	0.26	1.09
US	1	1	1	1	0.04	0.24	1.64
UK	1	2	1	1	0.07	0.24	1.68
Ireland	0	3	1	1	0.11	0.33	1.45
New Zealand	0	2	1	1	0.07	0.24	1.88
EUCON							
Australia	1	3	2	1	0.22	0.23	1.58
Belgium	1	3	2	2	0.44	0.45	1.44
France	1	3	2	2	0.44	0.44	1.41
Germany	1	3	2	3	0.67	0.39	1.55
Italy	1	3	2	2	0.44	0.44	0.68
Netherlands	1	3	2	2	0.44	0.42	1.88
Spain	1	3	2	1	0.22	0.33	1.27
Switzerland	0	2	1	3	0.22	0.33	1.98
Portugal	0	3	2	2	0.44	0.26	0.87
Greece	0	3	2	2	0.44	0.38	0.57
NORDIC							
Finland	1	3	2	3	0.67	0.49	1.52
Norway	1	3	3	3	1	0.38	1.77
Sweden	1	3	3	3	1	0.64	1.60
Austria.	0	3	3	3	1	0.46	1.55
Denmark	0	3	3	3	1	0.43	1.65

DT equals 1 if the country was in the sample analysed by Daveri and Tabellini (2000) and 0 otherwise. Data for union coverage and coordination taken from Nickell (1997), Table 5. Relative product is defined as the product of union coverage and union and employer coordination relative to the value for Sweden. Union coverage refers to the percentage of workers covered (1=0-25%, 2=25-75%, 3=75-10%). Union coverage for Greece was 90% according to ILO (1997), Table 1.2. Union and employer coordination rank 3=high, 2=middle and 1=low. Data for Greece comes from Franzese (2002). Average labour tax rates from 1995 to 1999 are from Boscá, García and Taguas (2005). The source of the government efficiency index for 1996 is Kaufmann, Kraay and Mastruzzi (2003).

ately. Again, we can observe that in some periods (for example, in the sixties) labour taxes increased whereas unemployment rates remained unchanged or even decreased. Finally, in *NORDIC* countries the correlation between labour taxes and unemployment rates is more erratic, due to the increase of the unemployment rate during the first half of the nineties. As in *EUCON* the correlation between unemployment and labour taxes was close to zero until the mid seventies, and positive from the mid seventies to the mid eighties.

In column [1] of Table 1 we show the estimation results of the basic equation

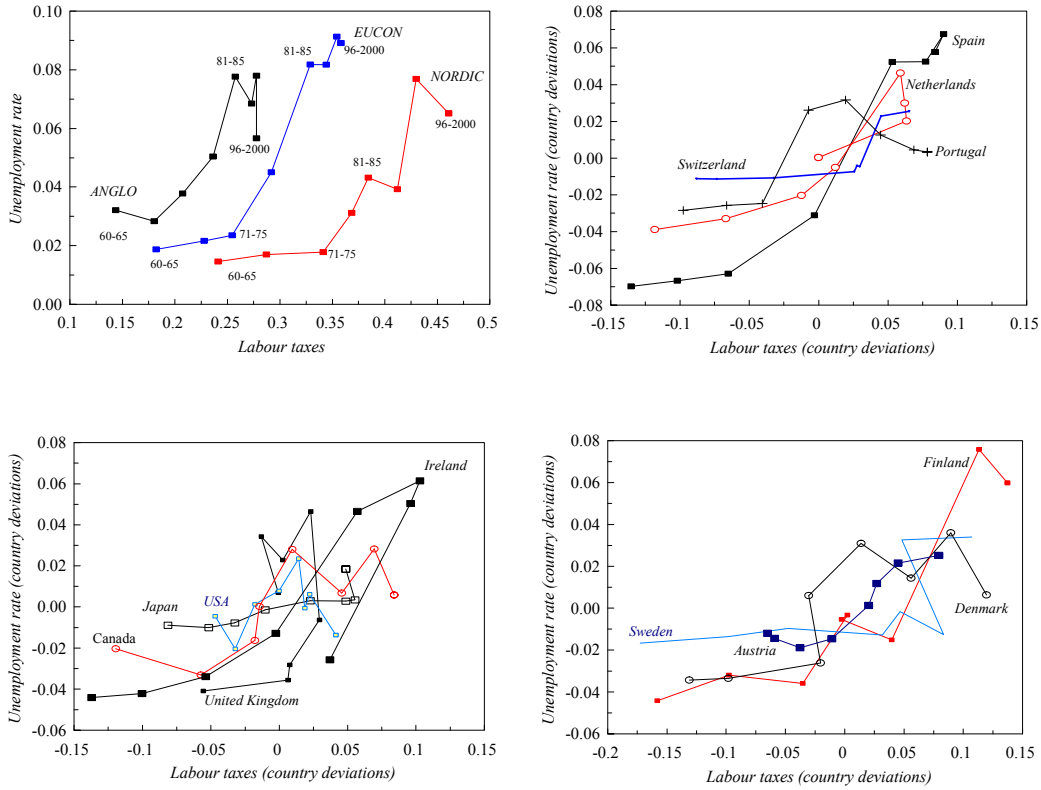

Figure 1: *Labour taxes and unemployment rates in OECD countries. Five years averages.*

proposed by DT for a larger sample of years (from 1965-90 to 1960-2000) and countries (from 14 to 21 OECD countries), distributed in the three samples considered:

$$\begin{aligned} u_{it} &= \alpha_i + \beta_j \tau^l_{it} + \delta_t + \varepsilon_{it} \\ t &= 60-65, 66-70, 71-75, ..., 96-2000 \\ i &= 1, ..., 21; \qquad j = 1, 2, 3. \end{aligned} \tag{1}$$

where u_{it} and τ^l_{it} are five-years averages of the level of unemployment and labour taxes in the eight subperiods from 1960 to 2000, α_i are country-specific dummies and δ_t are the time dummies for each subperiod. Equation (1) allows for different slopes (β_j) in each of the three samples we consider. The results in column [1] of Table 2 confirm the basic results obtained by DT and show that the rise in labour taxes could explain the increase in unemployment rates in EUCON countries, and to a lesser extent in the other

Table 2
Unemployment and labour taxes

	[1]	[2]	[3]	[4]	[5]
Dep.vble.:	u_{it}	Δu_{it}	Δu_{it}	u_{it}	u_{it}
β_{anglo}	0.204	0.263	0.177	0.100	0.100
	(3.39)	(1.83)	(1.65)	(1.23)	(1.23)
β_{eucon}	0.323	0.214	0.137	0.153	0.105
	(6.56)	(3.00)	(1.60)	(2.50)	(1.84)
β_{nordic}	0.152	0.017	-0.060	0.102	0.102
	(2.72)	(0.15)	(0.63)	(1.48)	(1.48)
δ_t	yes	yes	yes	no	no
α_i	yes	yes	yes	no	no
N.obs.	166	145	141	166	158
$s.e.e.$	0.016	0.016	0.015	0.011	0.010

White's robust $t-$ratios in brackets.

two samples. However, although β is larger for EUCON, contrary to DT's results when we extent the sample across countries and time, the restriction that the coefficients for the three groups are equal cannot be now rejected.

DT also show that their results survive to the estimation of equation (1) in first differences, as in column [2]. In this case, labour taxes are no longer significant in NORDIC and ANGLO countries, and the exclusion of just two observations for EUCON countries (Spain in the first half of the eighties and Greece in the first half of the seventies) also renders β_{eucon} insignificant, as shown in column [3].[6]

A more detailed analysis shows that even in each sample there are important differences in the correlation between u and τ^l across countries and subperiods. Figure 1 shows some of these correlations after taking country-specific averages (that is, $u_{it} - \overline{u}_i$ and $\tau^l_{it} - \overline{\tau}^l_i$ respectively). As we can see, the correlation varies across countries but it is also very variable for the same country in different periods. For example, in the Netherlands and Spain labour taxes increased considerably between 1960 and 1975 but unemployment rates remained unchanged, whereas in Portugal labour taxes increased from the mid eighties whereas the unemployment rate decreased. In some ANGLO

[6] The other two omitted observations are for ANGLO countries (Ireland in mid 80s) and for NORDIC countries (Finland at the beginning of the 90s).

countries we observe similar results: in Ireland the correlation between u and τ^l is comparable to the case of Spain and in the USA and Canada unemployment rates increased with labour taxes from the beginning of the seventies to the mid eighties. Finally, again NORDIC countries exhibit an erratic correlation. This empirical evidence shows countries in which there is a positive correlation between u and τ^l in some particular episodes, characterized by a poor economic growth (bad times) whereas in other periods, when growth was high (good times), this correlation is null.

The case of Spain is very illustrative since the increase in the unemployment rate from the mid seventies to the mid eighties coincided with a steady increase in labour taxes (which was not particularly different from the rest of the periods), but also with an important slowdown in total factor productivity growth, aggressive monetary policies to slow down inflation and expansive fiscal policies that gave place to very high real interest rates. As noted by Blanchard and Wolfers (2000) and Nickell, Nunziata and Ochel (2005) these variables as well as the change of labour-market institutions (employment protection, benefit replacement ratios, coordination, etc.) have been responsible for important increases in unemployment rates in industrialized countries. Therefore, a reasonable critique to the previous approach is that since there are other explanations of unemployment, the correlation between u and τ^l may be misspecified due to a possible problem of omitted variables.

To disentangle the unemployment effects of labour taxes from the effects of other time-varying labour market institutions and shocks, we have followed here the contribution by Nickell, Nunziata and Ochel (2005), working with the components of unemployment and labour taxes which are orthogonal to other potential determinants of unemployment such as labour market institutions and several types of shocks, that is:

$$\widehat{u}_{it} = \beta_j \widehat{\tau}^l_{it} + \varepsilon_{it} \tag{2}$$

where

$$u_{it} = \alpha^u_i + \delta^u_t + \boldsymbol{\gamma}^u \mathbf{X}_{it} + \widehat{u}_{it} \tag{3}$$

$$\tau^l_{it} = \alpha^\tau_i + \delta^\tau_t + \boldsymbol{\gamma}^\tau \mathbf{X}_{it} + \widehat{\tau}^l_{it} \tag{4}$$

$$t = 1960-70, ..., 1996-2000; i = 1, ..., 21; j = 1, 2, 3.$$

The set of explicative variables in X includes the lagged unemployment rate, employment protection, the benefit replacement ratio, benefit duration, union density, coordination, labour demand, total factor productivity, real import price and money supply

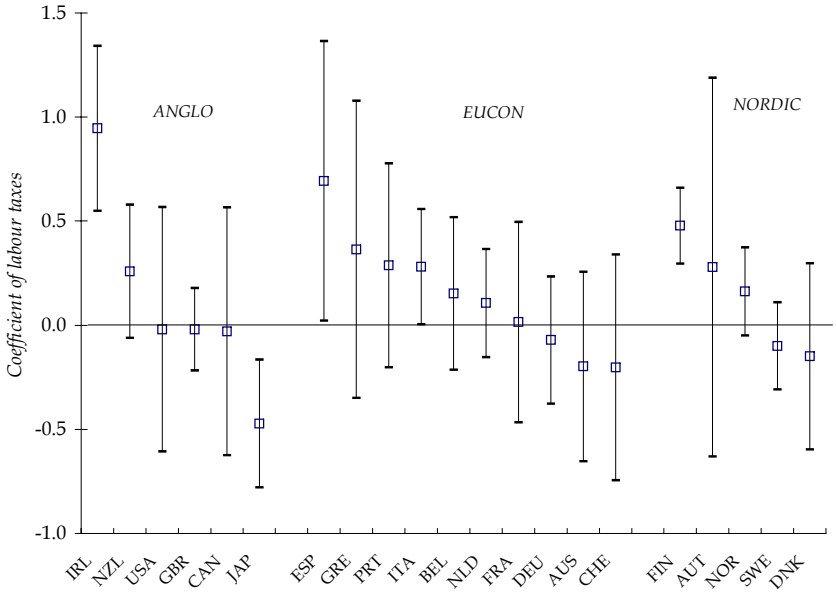

Figure 2: *Estimated coefficient of labour taxes for each country and its confidence interval using orthogonal components as in equation (2).*

shocks, and the real interest rate. As we can see in column [4], β_j is only statistically significant in the EUCON sample. However, this result is driven by the performance of unemployment and taxes in Spain between 1975 and 1985. As we exclude Spain from the sample in column [5], β_{eucon} is no longer significant, and it is close to the values of this coefficient estimated for ANGLO and NORDIC countries.

To get some insights about the results in column (4) of Table 2, we have estimated β for each country, as well as the confidence intervals. The results of this exercise are presented in Figure 2, with countries grouped in the three groups considered. There are several points which are worth mentioning. First, there is an important heterogeneity within each group. Second, there is not a clear pattern between groups. Thus, the variance within groups is larger than the variance between groups. Third, it is possible to find en each group countries in which the correlation between labour taxes and unemployment is clearly positive (Ireland, New Zealand, Spain, Italy and Finland) or negative (only significant in the case of Japan.

Summarizing these results, the positive relationship between labour taxes and the unemployment rate is far from being robust, since there is a large amount of heterogeneity in the correlation between both variables across time and countries. As we have shown, after controlling for other potential determinants of the unemployment rate,

countries with similar levels of coordination and union coverage (e.g., Spain versus Germany) show a different unemployment rate response to increases in labour tax rates, and even in the same country (e.g., Spain in the sixties and eighties) the response changes over time, with no variation in unions and employers coordination. Therefore, it is necessary to offer alternative explanations which can complement the existing mechanisms that account for different patterns across countries and, at the same time, explain why in some cases the unemployment rate remains invariant or even decreases after augments in the labour tax rates. This is precisely the aim of the following sections.

3. The model

We incorporate unemployment, caused by the wage-setting behaviour of a monopolistic union, in a neoclassical growth model which integrates a quite detailed structure of taxes used to finance productive public expenditures and social transfers and parameterizes the inefficiency of government to transform taxes into public goods or transfers. The advantage of such a (general equilibrium) framework is that we can take into account the interaction between the decisions made by different agents in the economy. For simplicity, we assume that growth is exogenous. Although this assumption implies that taxes have no effects upon the rate of growth but on the level of productivity, it is not crucial for the results we will obtain for the unemployment rate.[7]

We consider a one-sector closed economy characterized by a constant population. In order to simplify the model, we assume that the labour supply (l^s) and the total population (l^T) are the same. Normalizing the total population of this economy to one, the unemployment rate is given by the number of unemployed individuals ($1 - l^d$):

$$l^T = l^s = 1.0 = l^d + (1 - l^d). \tag{5}$$

This normalization also implies that total production and its composition can be directly interpreted in per capita terms.

3.1 Households

We assume that there is a representative household which chooses an optimal consump-

[7] In Daveri and Tabellini's (2000) endogenous growth model, taxes affects long-run growth. However, as shown by these authors, the model is recursive and higher taxes permanently increase unemployment independently of what happens to long-run growth or to long-run per capita income

tion path to maximize the following intertemporal utility function:

$$U(0) = \int_0^{\infty} e^{-\rho t} u(c_t) dt \tag{6}$$

where ρ is the discount rate, c_t is private consumption. As usual, $u(c_t)$ is characterized by a constant intertemporal elasticity of substitution. In particular,

$$\begin{aligned} u(c_t) &= \frac{(c_t)^{1-\theta}}{1-\theta} \qquad if \qquad \theta \neq 1 \\ u(c_t) &= \ln c_t \qquad if \quad \theta = 1 \end{aligned} \tag{7}$$

where $1/\theta$ is the elasticity of substitution.

This household receives three different types of income. First, labour is remunerated at the wage w_t, which is used to finance direct taxes τ^d, such that

$$\tau^d = \tau^l w_t + a_t \tag{8}$$

where τ^l is a proportional tax rate on the wage, and a allows direct taxes to be proportional ($a_t = 0$), progressive ($a_t < 0$) or regressive ($a_t > 0$).

Second, the household obtains a capital income ($r_t k_t$) which is taxed at the rate τ^k. Third, employees receive a public transfer tr_t. Finally, they also receive unemployment benefits (s_t) from government, which are proportional to the number of unemployed members and are taxed at the rate $(\tau^l - a^s)$.With all this income, the household finances its consumption and investment decisions. Therefore, the household budget restriction is given by

$$\begin{aligned} & l_t(w_t(1-\tau^l) - a_t + tr_t) + r_t(1-\tau^k)k_t + (1-l_t)\left[s_t\left(1-(\tau^l - a^s)\right) - a_t\right] \\ = \;& (1+\tau^c)c_t + \dot{k}_t + \delta k_t, \end{aligned} \tag{9}$$

where consumption is taxed at the rate τ^c, δ is the depreciation rate and $\dot{k}_t$ is net investment. As we can see, if $a^s > 0$ the wage is taxed at a rate which is higher than the rate on unemployment benefits.

3.2 Firms

Firms decide the optimal demand of physical capital (k_t) and labour (l_t^d), taking as given the level of productive public expenditure (g_{pt}). We assume that the production function is the same for all firms, it exhibits exogenous technical progress and decreasing returns

for each factor of production. In particular, we assume that

$$y_t = A_t^{1-\alpha-\varepsilon} k_t^{\alpha} g_{pt}^{\varepsilon} (l_t^d)^{1-\alpha} \tag{10}$$

where $A_t = A_0\ e^{\gamma t}$, γ is the exogenous rate of technical progress and $0 < \alpha + \varepsilon < 1$. Firms sell their goods in a competitive market, in which the price is normalized to 1.0. They also demand labour and capital until their marginal products equal the user costs.

$$r_t = \alpha \frac{y_t}{k_t} \tag{11}$$

$$w_t = (1-\alpha) \frac{y_t}{l_t} \tag{12}$$

Taking the wage as given in equation (12), labour demand is determined as

$$l_t^d = \left[\frac{(1-\alpha) A_t^{1-\alpha-\varepsilon} k_t^{\alpha} g_t^{\varepsilon}}{w_t} \right]^{1/\alpha} \tag{13}$$

3.3 The government budget constraint

Government finances a path of public goods, transfers and social benefits using different taxes on consumption and the incomes from labour and physical capital. For simplicity, we assume that the government budget is balanced in each period:

$$\begin{aligned} & (1+\eta)(g_{pt} + l_t tr_t + (1-l_t) s_t) \\ = \ & \tau^c c_t + \tau^k r_t k_t + w_t l_t \tau^l + (1-l_t)(\tau^l - a^s) s_t + a_t \end{aligned} \tag{14}$$

where η is the level of inefficiency of the government to finance its public expenditure. We can think of the government budget constraint as a quasi-production function for the government: given a level of taxes collected more corrupt or inefficient governments (higher η) will produce a lower level of public goods, transfers and social benefits. In general, the value of η will be a function of the administrative costs of managing taxes revenues (for example, to avoid tax evasion or corruption, Perotti, 1993, y Bearse et al., 2004) and the provision of public goods and services. The multiplicative specification is chosen by its simplicity and by the fact that administrative costs are greater the larger the size of the government.

Taking into account the government budget restriction and the distribution of income between labour and physical capital, the resource budget constraint of the economy is given by

$$\dot{k}_t = y_t - c_t - (1+\eta) g_{pt} - \eta \left[(1-l_t)\, s_t + l_t tr_t \right] - \delta k_t \tag{15}$$

When $\eta = 0$, equation (15) collapses to the standard budget constraint

$$\overset{\bullet}{k}_t = y_t - c_t - g_{pt} - \delta k_t. \tag{16}$$

Following Turnovsky (2000), we also assume that unemployment benefits per unemployed workers, public goods, transfers and the parameter that determines the progressivity of direct taxes represent an exogenous proportion of output or wage incomes:

$$s_t = \sigma_s y_t \tag{17}$$

$$g_{pt} = \sigma_p y_t \tag{18}$$

$$tr_t = \sigma_{tr} w_t \tag{19}$$

$$a_t = \sigma_a y_t. \tag{20}$$

These assumptions ensure that in the steady state all variables grow at the same rate.

3.4 Monopolistic Union

As it is well known, the existence of a non-competitive labour supply allows to obtaining situations in which some individuals can be unemployed. The easiest way to give rise to such a labour supply is by the introduction of a union which acts monopolistically deciding an optimal wage above the level that clears the labour market, as in Alesina and Perotti (1997) and Daveri and Tabellini (2000). A more general framework in which the union and the employers bargain over the wage and employment leads to the same qualitative conclusions (see Ooghe, Schokkaert and Fléchet, 2001). Once the wage has been set by the union, firms determine total employment, in line with the standard right-to-manage assumption (see Nickell, 1982, and Nickell and Andrews, 1983). Thus, when workers are organized in unions, they can partially translate labour taxes to firms through higher wages which produce lower employment.

In particular, the union seeks to maximize the workers' expected income:

$$\Omega = l_t \left[w_t(1-\tau^l) - a_t + \beta_t \sigma_{tr} w_t \right] + (1-l_t) \left[s_t \left(1 - (\tau^l - a^s) \right) - a_t \right] \tag{21}$$

Employees receive a net wage and transfers that are proportional to w_t, whereas unemployed workers only obtain unemployment benefits, that can be taxed at a lower rate than wages if $a^s > 0$.[8] The key parameter in equation (21) is β_t. If $0 < \beta_t \leq 1.0$, the union internalizes that some (or all) government transfers are related to the wage level, as in Alesina and Perotti (1997).[9] If economywide agreements involving the government exist (as in some European countries and years), the union is more likely to take into account the government budget constraint and the connection between taxes and transfers (β is equal to 1). On the contrary, in the absence of such economywide agreements, the union set the wage at the firm or sector level without fully internalizing the stream of transfers. The value of β is also related to the way workers value payroll taxes in other labour market models where labour supply is competitive as, for example, in Gruber (1997) and Summers (1989), and there is a full linkage between taxes and benefits avoiding the effects on wages and employment of higher labour taxes.

Therefore, β may vary across countries and time depending, among other things, on the level of centralization of labour markets and the participation of government in labour-market agreements. Thus, if unions negotiate wages at the nation level they may be able to internalize the positive link between taxation and welfare benefits implicit in the government budget constraint. There are many experiences which serve as examples of a value of β close to one as, for example, the anecdotal evidence in Scandinavian countries (see Alesina and Perotti, 1997), the Netherlands (Groot, 2001) or other European countries in the 90s (Visser, 2000). In other cases, the same unions may achieve quite different agreements about labour taxes and the welfare state with the government on power and firms representatives. For instance, the two main Spanish unions and the national employer association committed to low wage growth in economywide wage negotiations from 1979 to 1986, which involved also the government in 1985 and 1986 (see Díaz-Moreno and Galdón-Sánchez, 2005), years of high growth in labour taxes. However, the same unions did not achieve any economywide agreement in 1987 and 1988, even though the same party was on power. Therefore, β may change across

[8] As it is standard in the literature (e.g., Daveri and Tabellini, 2000) future wages will be set next period and they are not affected by current wage negotiations. In this circumstances, the union correctly takes future expected wages as given, and perceives no link between current wages and future decisions by firms. Anderson y Devereux (1988) have developed further this reasoning in Nash bargaining situations where neither firms nor unions commit to credible future strategies.

[9] Given the simplifications of our model, this assumption can be seen as too naive, since employees pay some taxes to the government that are used to finance current transfers. However, this is a straightforward way of introducing some of the features of social security systems in many industrialized countries. For simplicity, we assume that these transfers are proportional to wages and are received only by employed workers, as in Alesina and Perotti (1997). The extension of these transfers to all workers does not change the main implications of the model.

time even with the same agents (unions, employers and government) because economy conditions change and make more difficult economywide wage negotiations. In these circumstances, wage bargaining takes place at industry or firm level, with β close to zero, since unions take social transfers as given and they do not internalize the government budget constraint.

3.5 Equilibrium unemployment

Taking into account (13), the maximization of (21) yields the following first order condition for the wage:

$$\begin{aligned} \frac{\partial \Omega}{\partial w_t} &= 0 = \frac{\partial l_t^d}{\partial w_t}\left[w_t(1-\tau^l) - a_t\right] + l_t^d(1-\tau^l) \\ &+ \frac{\partial l_t^d}{\partial w_t} w_t \beta_t \sigma_{tr} + l_t^d \beta_t \sigma_{tr} - \frac{\partial l^d}{\partial w_t}\left(s_t(1-(\tau^l - a^s)) - a_t\right) \end{aligned} \tag{22}$$

Multiplying this expression by w_t/l_t^d and given that the labour demand elasticity to wage is equal to $-1/\alpha$, equation (22) can be written as

$$\begin{aligned} \frac{\partial \Omega}{\partial w_t} &= 0 = -\frac{1}{\alpha}(w_t(1-\tau^l) - a_t) + w_t(1-\tau^l) \\ &- \frac{1}{\alpha} w_t \beta_t \sigma_{tr} + w_t \beta_t \sigma_{tr} + \frac{1}{\alpha}\left(s_t(1-(\tau^l - a^s)) - a_t\right) \end{aligned} \tag{23}$$

Rearranging (23) we obtain the wage set by the union

$$w_t = \frac{s_t(1-(\tau^l - a^s))}{(1-\alpha)(1-\tau^l + \beta_t \sigma_{tr})} \tag{24}$$

In the particular case in which there are no transfers ($\sigma_{tr} = 0$), unemployment benefits are not taxed and direct taxes on labour are strictly proportional ($a_t = 0$) we obtain the same solution for wages as Daveri and Tabellini (2000). As it is well known, if $\sigma_{tr} = 0$ labour taxes have effects upon wages (and then, upon the unemployment rate) only if unemployment benefits are taxed at a rate that is lower than that for wages ($a^s > 0$). Summarizing the preceding results, the wage set by the union can be interpreted as a mark up on the unemployment benefits net of taxes. This mark up is in general a negative function of the labour demand elasticity and the different tax rates on labour, and a positive function of transfers.

Substituting the wage (24) in the equation for the labour demand of firms (13) we

solve for the equilibrium employment level in the decentralized economy:

$$l_t = l_t^d = \left[\frac{(1-\alpha) A_t^{1-\alpha-\varepsilon} k_t^{\alpha} g_t^{\varepsilon}}{\frac{s_t(1-(\tau^l - a^s))}{(1-\alpha)(1-\tau^l+\beta_t \sigma_{tr})}} \right]^{1/(\alpha)} \tag{25}$$

Taking into account (17), labour demand (which in this case is also the employment rate since $l^T = l^s = 1.0$) can be written as

$$l_t = l_t^d = \frac{(1-\alpha)^2 (1-\tau^l+\beta_t \sigma_{tr})}{\sigma_s (1-(\tau^l - a^s))} \tag{26}$$

This equation shows clearly that there are multiple combinations of β_t, σ_{tr} and a^s for which labour demand remains unchanged with augments of τ^l. The model also shows that in a growing economy, as long as labour taxes and transfers (σ_{tr}) and unemployment benefits (σ_s) shares are constant, the wage, transfers and unemployment benefits grow at the same rate than output holding constant the demand of labour.

4. Labour taxes and unemployment

We can easily obtain the steady state values of the different variables of the economy, when consumption is optimally determined by the household in order to maximize its intertemporal utility (see the appendix). The steady state solution for $\dot{\mu}_1/\mu_1$, k/y, c/y, l, $w/e^{\gamma t}$ and $k/e^{\gamma t}$ is characterized by the system of equations in Table 2. Since the economy exhibits exogenous technical progress, this system of equations is recursive. Thus, in (ED.1) we get $\dot{\mu}_1/\mu_1$ given ρ, θ and γ, allowing to obtain the output to capital ratio using (ED.3)

$$\frac{y}{k} = \frac{1}{\alpha} (\delta + \rho + \theta\gamma) \tag{27}$$

Once we know y/k, equation (ED.2) can be used to compute the ratio of consumption to output. Finally, since (ED.6) determines the employment level, the level of capital in efficiency units (k/e^{yt}) is given by the production function (ED.4).

In Table 3 we show the steady state values of the main variables given a set of parameters which matches many of stylized fact in OECD countries. In particular, the elasticity of output to private capital (α) is equal to $1/3$. The value of the output elasticity to productive public expenditure (ε) is more controversial, as Gramlich (1994) has pointed out, since its estimated value ranges from 0 to 0.39. Nevertheless, Cassou and Lansing (1998) have shown that the observed decline in the US ratio of capital to private capital can be reconciled with optimal fiscal policy when the elasticity of output to

Table 2
The solution of the decentralized economy

$$-\frac{\dot{\mu}_1}{\mu_1} = \rho + \theta\gamma \quad \text{(ED.1)}$$

$$\gamma = \left[(1-(1+\eta)\sigma_p) - \eta(1-\alpha)\sigma_{tr} - \eta(1-l_t)\sigma_s - \frac{c}{y}\right]\frac{y}{k} - \delta \quad \text{(ED.2)}$$

$$-\frac{\dot{\mu}_1}{\mu_1} = \alpha\frac{y}{k}(1-\tau^k) - \delta \quad \text{(ED.3)}$$

$$\frac{y}{k} = A_0^{\frac{1-\alpha-\varepsilon}{1-\varepsilon}}\left(\frac{k}{e^{\gamma t}}\right)^{\left(\frac{\alpha}{1-\varepsilon}-1\right)}\sigma_p^{\frac{\varepsilon}{1-\varepsilon}}(l)^{\frac{1-\alpha}{1-\varepsilon}} \quad \text{(ED.4)}$$

$$w = \frac{s(1-(\tau^l-a^s))}{(1-\alpha)(1-\tau^l+\beta_t\sigma_{tr})} \quad \text{(ED.5)}$$

$$l = \frac{(1-\alpha)^2(1-\tau^l+\beta_t\sigma_{tr})}{\sigma_s(1-(\tau^l-a^s))} \quad \text{(ED.6)}$$

public investment (ε) is close to 0.08. The discount rate (ρ) is equal to 0.02 and the coefficient of relative risk aversion (θ) to 2, which is compatible with the microeconometric evidence for the elasticity of intertemporal substitution being less than one (see, for example, Attanasio and Weber, 1993). The annual depreciation rate was set to 0.05. The percentage of transfers upon output (σ_{tr}) was assumed to be 0.14, whereas the public consumption share (σ_p) was set to 0.2 which is similar to the value observed in many OECD countries in last decades.

For the tax rates we assume that they are the average for OECD countries between 1995-96, that is, τ^c=0.12, τ^k=0.26 and τ^l=0.38. The parameter σ_s was set equal to 0.48, implying a replacement ratio of 0.65 within the range of values presented by Blanchard and Wolfers (2000). In order to facilitate comparisons, A_0 is such that output in efficiency units ($y/e^{\gamma t}$) is equal to 1. For other parameters, the choice is more ambiguous. Thus, σ_a is such that 5 per cent of income is exempt of direct taxes, the inefficiency level (η) was set to 0.1 , and a^s was set to 0.15 in order to obtain an unemployment rate of 10 per cent. This value of a^s was close to the one observed on average in OECD countries where the tax rate on unemployment benefits is approximately half the tax rate on wages

Table 3
Calibration and steady state

Parameters		Variables	
ρ	0.020	c/y	0.60
θ	2.000	$\frac{\dot{k}+\delta k}{y}$	0.15
γ	0.020	$y/e^{\gamma t}$	1.000
α	1/3	$k/e^{\gamma t}$	2.24
ε	0.080	y/k	0.44
δ	0.05	$w/e^{\gamma t}$	0.74
A	0.887	u	0.100
η	0.100		
σ_{tr}	0.14		
σ_p	0.2		
σ_a	-0.05		
σ_s	0.48		
τ^k	0.26		
τ^c	0.12		
τ^l	0.38		
a^s	0.15		
β_t	1.000		

when gross and net replacement rates are compared (see OECD *Jobs Study*, 1994, Table 8.b.1). As we can see in Table 3, we obtain reasonable values for y/k (0.44), c/y (0.60), the saving rate (0.15), the unemployment rate (0.1), and the ratio of wages to output (0.74). As shown before, wages, transfers and unemployment benefits grow at the same rate than output holding constant the unemployment rate.

Taking this steady state as a baseline, it is possible to perform different numerical exercises that show how endogenous variables, specially the unemployment rate, are affected by changes in the distortionary tax rates. Given the empirical evidence we have shown in the second section, it is interesting to analyze to what extent changes in labour taxes (for example, in τ^l) could have no effects upon the unemployment rates when other variables, which characterize fiscal policy, are also varying (for example, σ_{tr}). In other words, we can have an alternative explanation of the empirical evidence observed in industrialized countries in which, during many years, labour tax rates increased without any augment of the unemployment rates, also helping to understand the absence of a correlation between both variables in the cross-section of OECD countries.

Using the parameter values of Table 3, we have simulated the combinations of τ^l,

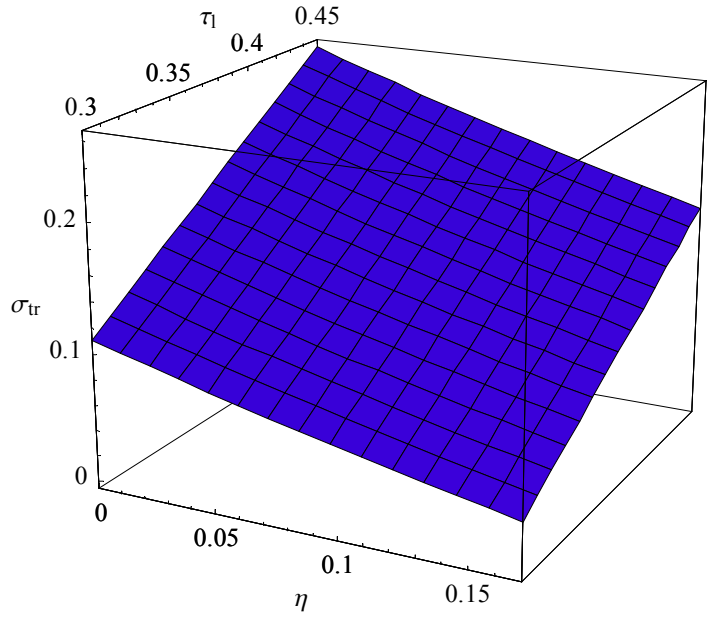

Figure 3: *Combinations of labour taxes, transfers and government efficiency which allow to maintaing the unemployment rate at 10 per cent level.*

σ_{tr} and η which allows to maintaining the unemployment rate at 10 per cent. In Figure 3 we show the result of this exercise. For a given value of the government efficiency level, the unemployment rate remains constant if both transfers and tax rates on labour income increase. This figure is illustrative of the main idea behind the results of the empirical section: it is difficult to relate increases in labour taxes τ^l with augments in unemployment rates without controlling for other variables which can be important in wage bargaining. Although the mechanisms in which higher labour taxes give rise to lower employment through shifts of labour demand may be correct, we should also bear in mind other elements which can be crucial in the determination of wages and can be changing simultaneously with taxes. In other words, when other variables such as transfers are introduced in the wage bargaining, we can find a wide range of results in the relationship between taxes and unemployment.

5. Empirical and policy implications

As we have shown, the monopolistic union model not always predicts a positive relationship between taxes and unemployment. The correlation between both variables may be positive or null, depending on the way unions internalize the linkage between taxes and public transfers. Summers, Gruber and Vergara (1993), Gruber (1997) and Alesina and

Perotti (1997) have also point out that if the taxes/benefits linkage is taken into account by workers/unions higher taxes do not cause higher wages. Following Alesina and Perotti (1997) this happens in countries with highly centralized labour markets (according to the Calmfors and Driffill's, 1988, ranking).

Our line of reasoning is that the correlation between taxes and unemployment is more complex than previously assumed. First, because it is very difficult to summarize in one simple index the complexity of wage bargaining. The degree of centralization is only one among the several determinants of wage bargaining and the distinction between centralization and coordination (see, for example, Nickell et al., 2005) may be very relevant: in many countries unions bargain at the industry or sectoral levels following the guides decided at the national level. Secondly, because centralization and coordination indices have changed over time. Thirdly, even in countries where coordination is high, there are many examples in which economywide agreements are not reached some years and, therefore, there is no coordination between unions (demanding higher wages) and the governments (increasing taxes). Finally, even in countries with highly coordinated labour markets the taxes/benefits linkage may be severely affected by the government inefficiency in the provision of social benefits due to tax evasion, administrative costs, corruption, etc. For all these reasons, the internalization of social benefits by unions (capture in our model in parameter β_{it}) should be country and time specific.

It is obvious that a simple economic model cannot be able to represent the complexity of labour markets in OECD countries. Any model (and ours is not an exception) is a simplification of reality. Nevertheless, although in many countries unions bargain at the sector level what is really important is the degree of coordination (see, for example, Soskice, 1990, and Nickell et al., 2005), that is, if wage setting is coordinated across the economy even when the location of bargaining is at the firm or sector level.

When economy wide coordination exists the internalization of the government budget constraint is helped by labour market agreements where the government is involved and all agents (unions, firms and government) negotiate also about fiscal policies as, for example, in the case of social contributions or public pensions systems. There are many examples of such agreements in last decades which have lead to the participation of unions in the administration of welfare state systems in many European countries (see, among others, Visser, 2000) where unions help determine the minimum wage (France), administer the unemployment benefit system (Belgium, Denmark, Finland and Sweden) or the health and pension systems in (France and Germany).

In some circumstances there are no social and labour market national negotiations or agents have failed to achieve economywide agreements. In these cases the perception

of the taxes/benefits linkage by the unions may or may not exit depending among other things on the strategic behaviour of unions and the expectations of future negotiations.

In general, the objective of unions and the link with their affiliates are difficult to represent in a simple abridged form. In our model, the union's objective function can also be sensitive to variables such as transfers which depend on the wage set by the union and the unemployment rate. The way these transfers enter in the objective function depend on the parameter that links some transfers to wages when working (σ_{tr}) and the perception of workers of how taxes are used to finance more transfers (β_t). It is also possible that the value of β_t changes depending on the growth prospects of the economy. In periods of high growth (for example, during the sixties), workers are willing to accept higher labour taxes in order to finance more transfers and social benefits, whereas during recessions (i.e., from mid seventies to mid eighties) it is more difficult for the government to raise labour taxes without any incidence on real wages. *One of the advantages of a centralized wage bargaining process is that the government, unions and employers* can agree about the size of the welfare state and about its financing, trying to avoid the negative effects upon employment.

Another important feature of our model is that the unemployment rate is a function of the government inefficiency level. To see more clearly this implication let us assume that $a_t^s = \tau^l$, $a_t = 0$ and that transfers are financed solely using labour taxes such that $(1+\eta)\sigma_{tr} = \tau^l$. In this case the employment rate is give by

$$l_t^d = \frac{(1-\alpha)^2}{\sigma_s}\left(1 - \tau^l + \beta_t \frac{\tau^l}{(1+\eta)}\right) \tag{28}$$

Only when $\beta = 1$ and $\eta = 0$ labour taxes do not exert any effect on the employment rate, whereas the effects are greater the larger the value of η and the smaller the value of β. Another implication of our model is that if labour taxes are used to finance public dissipative expenditures then higher taxes will produce higher unemployment rates, thus suggesting that the structure of public spending may be very relevant. Notice that our model also offers an explanation of the assumption usually made by some authors (as, for example, Layard, Nickell and Jackman, 1991) that the effects of taxes increases do not last forever and that taxes in the long run are borne by labour, with no change in equilibrium unemployment, if there is a learning process in which unions internalize a bigger amount of public transfers (therefore increasing β_{it} towards 1).

The preceding result can be used to explain to some extent the cross-section evidence and the changes in the correlation between unemployment and labour taxes in some countries, since the empirical evidence supports a negative correlation between unemployment and government efficiency. For this exercise we have used the 1996 gov-

Table 4
Unemployment and government efficiency

	[1]	[2]	[3]	[4]	[5]
Dep.vble.:	$\overline{u}_{i,95-99}$	$\overline{u}_{i,95-99}$	$\overline{u}_{i,95-99}$	$\overline{u}_{i,95-99}$	$\overline{u}_{i,95-99}$
$effic_{i,96}$	-0.036	-0.042		-0.035	
	(2.61)	(2.05)		(2.78)	
$\overline{\tau}^{l}_{i,95-99}$			0.141	0.090	0.391
			(1.64)	(1.51)	(5.03)
$\overline{\tau}^{l}_{i,95-99}effic_{i,96}$					-0.156
					(4.28)
Controls?	No	Yes	Yes	No	Yes
N.obs.	21	21	21	21	21
R^2	0.17	0.29	0.26	0.24	0.43

White's heteroscedasticity-consistent t-ratios in parentheses below each coefficient.

ernment efficiency measure ($effic_i$, last column of Table 1) constructed by Kaufmann, Kraay and Mastruzzi (2003), since there are no earlier estimates of this variable. These authors define government efficiency as an aggregate governance indicator that measure perceptions of the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies into a single grouping.

In column (1) of Table 4 we have regressed the average unemployment rate from 1995 to 1999 ($\overline{u}_{i,95-99}$) on the 1996 government efficiency measure ($effic_{i,96}$). As we can see in column there is a negative and significant correlation between the unemployment rate and government efficiency with a t-ratio equal to -2.61. In column (2) control for other determinants of the unemployment rate estimating a cross section equation similar to Nickell's (1997) specification, where we include as controls the coordination rate, benefits duration and replacement rates, union density, employment protection and the expenditure in active labour market policies. Again government efficiency is negative and statistically significant, in contrast with average labour taxes ($\overline{\tau}^{l}_{i,95-99}$) in column (3). When we include simultaneously the government efficiency index and labour tax rates with no other regressors (column (4)) $effic_{i,96}$ maintains its negative and significant

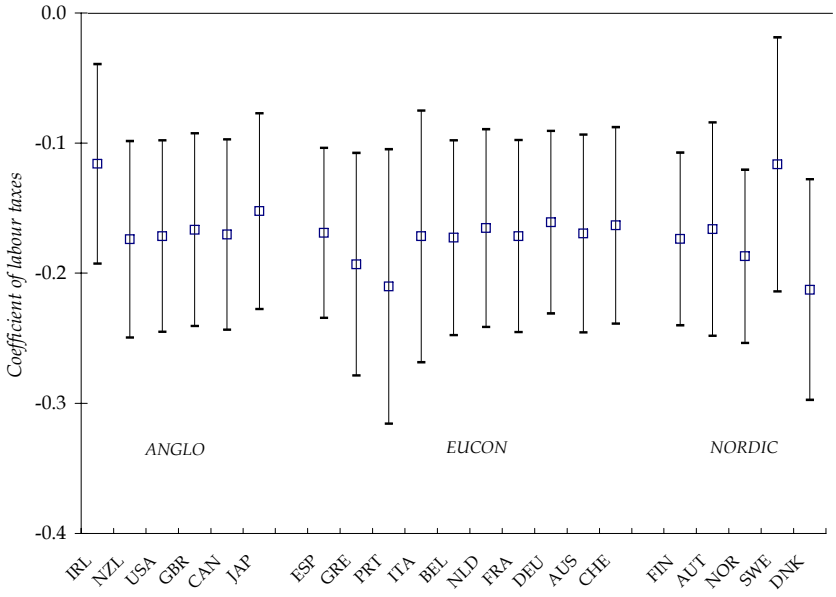

Figure 4: *Coefficient of the interaction term between average labour taxes ($\overline{\tau}_i^l$) and government efficiency (effic_i) estimated for all the possible subsamples obtained by deleting one country at a time.*

coefficient. This regression suggests that taxes and government efficiency may interact together as in equation (28). In column (5) we include labour taxes and its interaction with government efficiency, controlling for the same variables as in columns (2) and (3). Now, both labour taxes and their interaction with government efficiency are highly significant, obtaining also better results than in specifications where taxes interact with coordination and union coverage. Given the coefficients estimated in column (5) the effects of labour taxes on unemployment almost vanish in countries with a high government efficiency index (around 2).

As an additional test about the robustness of government efficiency, we have reestimated the specification in column (25) for all the possible subsamples obtained by deleting one country at a time. Figure 4 displays the estimated coefficient and the 95 per cent confidence interval around it, using the same country ordering as in Figure 2 As can be seen, our estimates remain negative and significantly different from zero at conventional confidence levels even in the most unfavourable cases, denoting that no influential observations are driven the results in Table 4.

Nordic countries, which are distinguished by high levels of labour taxes, have public sectors operating with high efficiency levels. As these countries are also charac-

terized by a centralized wage bargaining, a high share of GDP devoted to active labour market policies and low values of η, the finance of their welfare state led to high levels of taxes which did not result in excessive real wages and lower employment. On the contrary, in Spain, which drives some of the empirical results presented in the second section for EUCON countries, higher labour taxes were positively correlated with unemployment from the mid seventies to the mid eighties when the economic slowdown was more intense, particularly in years where the efficiency in the provision of public goods may have been low.

6. Conclusions

This paper tries to integrate in a unified framework some aspects related to growth, fiscal policy and unemployment. Most of the growth models assume that there is no imperfections in the labour market and therefore, full employment of productive factors. Thus, unemployment was understood as a short run problem related to business cycles. However, in the latter years some papers have considered employment as another endogenous variable in growth models.

In general, the idea that unemployment is due to some kind of interactions between institutional characteristics and shocks affecting the performance of the economy is widely extended. Among these institutional elements, those related with labour taxes have been traditionally considered as important determinants of the unemployment rate. This explains the interest in the search, at the theoretical and the empirical level, for taxes reforms which give rise to higher employment rates, shifting labour taxes to other goods or factors.

Although the common perception that higher labour taxes are related to higher unemployment rates is widely extended, it is not corroborated in a very robust way neither in different periods nor in a cross-section of OECD countries when we analyse the empirical evidence during the last decades. Although institutional differences in wage bargaining can partially explain the cross-section evidence, they cannot explain why in some countries we can find very different correlations between unemployment and labour taxes in different periods. For this reason, we have analysed the relationship between unemployment and taxes in a model in which the correlation between both variables is conditioned by other determinants such as transfers, public goods and services or the government inefficiency level. As we have seen, increases in labour taxes can have different effects if they are used to finance higher levels of social benefits for workers or not.

The main conclusion of the model we have presented is that the correlation between the unemployment rate and labour taxes is affected by the tax and public spend-

ing structure, by how workers internalize the financing of the welfare state and by the efficiency of governments to produce public goods and services using different tax resources. The model also points out that the agreements between the government, unions and employers about fiscal policy and the welfare state are crucial in order to avoid the negative effects that labour taxes may have upon employment. The analysis of the influence of the progressivity of taxes, the expenditure structure and the level of some transfers on unemployment at empirical level is a natural extension of this research.

7. References

Alesina, A. and R. Perotti (1997): "The Welfare State and Competitiveness". *American Economic Review,* 87(5), 921-939.

Anderson, S. y M. Deveroux (1988): "Trade Unions and the choice of capital stock". *Scandinavian Journal of Economics*, 90 (1), 27-44..

Attanasio, O. P. and G. Weber (1993):"Consumption Growth, the Interest Rate and Aggregation". *Review of Economics Studies,* 60 (3), 631-49.

Bean, C., R. Layard and S. Nickell (1986): "The Rise in Unemployment: A multi-country study". *Economica*, 53, S1-S22.

Bearse, P., G. Glomm y E. Janeba (2000): "Why Poor Countries Rely Mostly on Redistribution in Kind". *Journal of Public Economics*, 75, pp. 463-481.

Blanchard, O. and J. Wolfers (2000): "The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence". *Economic Journal, 110 (462), 1-33.*

Boscá, J.E., J. R. García and D. Taguas (2005): "La Fiscalidad en la OCDE: 1965-2001". Mimeo. Ministerio de Economía y Hacienda.

Bovenberg, A. and F. van der Ploeg (1998): "Tax Reform, Structural Unemployment and the Environment". *Scandinavian Journal Economics,* 100 (3), 593-610.

Calmfors, L. and J. Driffill (1998): "Bargaining Structure, Corporatism and Macroeconomic Performance". *Economic Policy*, April, pp. 14-61.

Daveri, F. and G. Tabellini (2000): "Unemployment, Growth and Taxation in Industrial Countries". *Economic Policy*, April, 49-104.

Díaz-Moreno, C. and J. E. Galdón-Sánchez (2005): "Collective Bargaining under Perfect Information. The Negotiation of National Agreements". *Spanish Economic Review*, 7(2), 139-156.

Elmeskov,J., J.P. Martin and S. Scarpetta (1998): "Key Lessons for Labour Market Reforms: Evidence from OECD Countries Experiences". *Swedish Economic Policy Review*, 5 (2), Autumn.

Franzese, R. J. Jr. (2002): *Macroeconomic Policies of Developed Democracies*, Cambridge Studies in Comparative Politics, Cambridge University Press.

Groot, L.F.M. (2001): "Tax Level and Tax Internalization Effects on Union Wafe Bargaining". *De Economist*, 149(2), 219-32.

Gruber, J. (1997): "The Incidence of Payroll Taxation: Evicence from Chile". *Journal of Labor Economics*, Vol 15, n° 3, pt. 2.

ILO (1997): *World Labour report 1997-98. Industrial Relations, democracy and Social Stability*. Technical Report. International Labour Organization.

Jackman,R., R. Layard and S. Nickell (1996): "Combatting Unemployment: Is Flexibility enough?". Discussion Paper No. 293, Centre for Economic Performance.

Kaufmann D., A. Kraay and M. Mastruzzi (2003): "Governance Indicators for 1996-2002". World Bank Policy Research Working Paper 3106.

Kiander J., J. Kilponen and J. Vilmunen (2000): "Taxation, growth and Unemployment-Does Collective Bargaining Matter?". Government Institute for Economic Research and Bank of Finland.

Kolm, A. S. (1998): "Differentiated Payroll Taxes, Unemployment, and Welfare". *Journal of Public Economics*, 70, 255-271.

Koskela, E., R. Schob and H. Sinn (1998)**:** "Pollution, Factor Taxation and Unemployment". *International Tax and Public Finance*, 5, 379-396.

Layard, P., S. Nickell and R. Jackman (1991): *Unemployment-Macroeconomics Performance and the Labour Market*, Oxford University Press, Oxford.

Mendoza, E., G. Milesi-Ferretti and P. Asea (1997)**:** "On The Ineffectiveness of Tax Policy in Altering Long-run Growth: Harberger `s Superneutrality Conjecture". *Journal of Public Economic* 66, 99-126.

Nickell, S. (1982): "Wage and Unemployment: A General Framework". *Economic Journal*, 92(365), 51-55.

Nickell, S. and Andrews, M. (1983): "Unions, Real Wages and Employment in Britain 1951-79". *Oxford Economic Papers*, 35, supplement November, 183-206.

Nickell, S. (1997): "Unemployment and Labor Market Rigidities: Europe versus North America". *Journal of Economic Perspectives*, 11(3), 55-74.

Nickell, S and R. Layard (1999): "Labour Market Institutions and Economic Performance", in O. Ashenfelter and D. Card, (eds), *Handbook of Labour Economics*, Vol 3, North-Holland, Amsterdam.

Nickell, S., L. Nunziata and W. Ochel (2005): "Unemployment in the OECD since the 1960s. What do we know?". *The Economic Journal*, 115, 1-27.

OECD (1994): *Jobs Study*. OECD. Paris.

Ooghe, E., E. Schokkaert and J. Fléchet (2001): "The incidence of social security contributions: an empirical analysis". Mimeo. Centre for Economic Studies, KULeuven.

Perotti R. (1993): "Political Equilibrium, Income Distribution, and Growth". *Review of Economic Studies, 60*, pp. 755-776.

Pissarides, C. (1998): "The Impact of Employment Tax Cuts on Unemployment and Wages: the Role of Unemployment Benefits and Tax Structure". *European Economic Review*, 42, 155-183.

Soskice D. (1990): "Wage determination: The changing role of institutions in advanced industrialized countries". Oxford Review of Economic Policy, Vol. 6, n 4.

Summers, L., J. Gruber and R. Vergara (1993): "Taxation and the Structure of Labor Markets: The Case of Corporatism". *Quarterly Journal of Economics*, 108, 385-412.

Turnovsky, S. (2000): "Fiscal Policy, Elastic Labor Supply and Endogenous Growth". *Journal of*

Monetary Economics, 45, 185-210

Tyrväinen, T. (1995): "Wage Setting, Taxes and Demand for Labour: Multivariate Analysis of Cointegrating Relations". *Empirical Economics*, 20(2), 271-97.

Visser, J. (2000): "Trends in Unionisation and Collective Bargaining". Mimeo. International Labour Office.

8. Appendix

8.1 Decentralized economy with distortionary taxation.

The representative household chooses an optimal consumption path that maximizes the utility function (7) subject to the budget constraint (9). Therefore, the Hamiltonian of the optimization problem in a decentralized economy corresponds to

$$\begin{aligned}\mathcal{H}_t &= e^{-\rho t}\frac{(c_t)^{1-\theta}}{1-\theta} + \lambda_t[r_t(1-\tau_t^k)\ k_t + l_t(w_t(1-\tau_t^l) - a_t) + tr_t \\ &\quad +(1-l_t)s_t(1-(\tau_t^l - a_t^s) - a_t) - (1+\tau_t^c)c_t - \delta k_t]\end{aligned} \tag{29}$$

where λ_t is the shadow price of physical capital.

The first-order conditions for the representative consumer when he accounts for τ_t^k, τ_t^l, $a_t^s, tr_t, \tau_t^c, a_t$, and l_t take the following expressions

$$e^{-\rho t}(c_t)^{-\theta} = \lambda_t(1+\tau^c), \tag{30}$$

$$-\frac{\dot{\lambda}_t}{\lambda_t} = r_t(1-\tau^k) - \delta, \tag{31}$$

which we may interpret in the usual way.