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WORKING PAPER

Employment and growth in Europe and the US

- The role of fiscal policy composition -

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A more recent version of this paper, extended with transitional dynamics, will be published in ***Oxford Economic Papers***. This new version is available upon request.

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EMPLOYMENT AND GROWTH IN EUROPE AND THE US
- THE ROLE OF FISCAL POLICY COMPOSITION -

Abstract

We analyze the impact of the composition of fiscal policy on employment and long-run growth. Our theoretical model builds on Barro (JPE, 1990) which we extend by endogenizing the decision to work and by allowing three kinds of government expenditures and three kinds of taxes. The model explains what we basically observe in the data for European countries: relatively high employment and growth in the Nordic countries, but poor employment and low growth in the core countries of the euro area. Our model can also explain employment and growth in the US.

***Keywords* :** fiscal policy, taxes, transfers, government spending, employment, endogenous growth

***JEL classification* :** E24, E62, J22, O41

1. Introduction

A growing body of literature attempts to explain the differences in the employment and growth performance of Europe and the US since the 1990s. The general perception is that the US have outperformed Europe on both indicators. When it comes to employment, many researchers emphasize the level and the evolution of taxes and labor market flexibility to explain the performance gap. The US show low taxes and high labor market flexibility, whereas countries like Germany, France and Belgium show exactly the opposite (see e.g. Wyplosz, 2001; Young, 2003; Prescott, 2004). Related research points to differences in product market flexibility (Nicoletti and Scarpetta, 2005). The policy implication of this view is obvious. Europe should reduce taxes and reform the labor and product market. Other authors emphasize differences in the desire for leisure between Europe and the US (Blanchard, 2004; Alesina et al., 2005). Cultural differences or differences in unionization and labor market regulations may be at the basis of a higher European taste for leisure. A recent third hypothesis explains higher employment in the US as the result of a much more extensive shift of traditional household production to the market (Freeman and Schettkat, 2005; Olovsson, 2004). Lower taxes on wages and higher degrees of labor market flexibility in the US may be among the factors that have contributed to this shift. When it comes to growth, differences in product market regulation are again at the center of the discussion. Various authors see higher entry costs, less intense competition and lower firm turnover as an important part of the explanation for Europe's disappointing growth in the last decade (e.g. Nicoletti and Scarpetta, 2003; Aghion and Howitt, 2005; Denis et al., 2005).

There is no doubt that all these explanations contain relevant elements to account for differences between Europe and the US. However, they are also incomplete. First of all, these explanations focus on only one side of the performance gap, either employment or growth, and neglect the other side. Second, each of these explanations will have difficulty clarifying macroeconomic performance in the Nordic countries. Countries like Sweden, Norway and Denmark also have high taxes, which increased during the last decades. They also combine many of the European labor and product market 'rigidities' (see e.g. Nicoletti and Scarpetta, 2005). Yet, as shown in Table 1 for 1995-2004, the Nordic countries on average have higher employment rates, both in persons and in hours, and higher per capita potential economic growth rates than the core countries of the euro area[2]. Compared to the US, per capita potential growth has been higher in the last decade in Finland and Norway. It has been about the same in Denmark. Only the employment rate in hours is much lower in the Nordic countries than in the US. Exception made for Finland, the employment rate in persons is similar. For later use, Table 1 also contains data for Switzerland, the UK and three so-called convergence countries, Ireland, Spain and Portugal.

[2] Growth differences are even more pronounced if one considers average actual growth over 1995-2004 as an indicator for potential growth. In the four Nordic countries average actual growth was 2.47% in this period. In the six euro area countries it was only 1.72%, in the US 1.98%.

Table 1. Employment and growth: Europe and the US (1995-2004)

	employment rate persons (in %)$^{\alpha}$	employment rate hours (in %) $^{\beta}$	real per capita potential GDP growth (average annual, in %) $^{\beta}$
Core euro area			
Austria	68.7	56.4	1.85
Belgium	58.9	48.2	1.81
France	61.0	48.1	1.77
Germany	65.6	50.3	1.38
Netherlands	71.0	50.3	2.18
Italy	54.6	45.8	1.44
Average	**63.3**	**49.8**	**1.74**
Nordic countries			
Finland	65.8	59.9	2.21
Denmark	76.3	58.6	1.92
Norway	78.0	56.0	2.71
Sweden	74.3	62.4	1.85
Average	**73.6**	**59.2**	**2.17**
Convergence EU			
Spain	55.8	52.7	2.29
Portugal	70.8	64.1	2.05
Ireland	62.6	55.6	5.22
Average	**63.1**	**57.4**	**3.17**
US	**75.1**	**71.3**	**1.93**
Switzerland	79.9	64.9	1.43
UK	72.7	64.9	2.14

Notes: Employment rate in persons is the ratio of total employment to population of age 15 to 64; Employment rate in hours is the ratio of average annual hours worked per person of age 15 to 64 to 1920. It has been calculated as the employment rate in persons times the ratio of average annual hours per employed worker to 1920. We consider 1920 to be the number of hours of a full-time worker (48 weeks times 40 working hours per week); Per capita GDP is GDP per person of age 15 to 64.
Sources: $^{\alpha}$ OECD, Department of Employment and Social Affairs, historical series; $^{\beta}$ OECD (2005), Economic Outlook.

In this paper we develop a theoretical model that explains both employment and long-run growth within a coherent framework. The paper emphasizes the role of the composition of fiscal policy. We allow for three kinds of taxes (taxes on labor income, capital income and consumption taxes) and three categories of government expenditures (productive expenditures, consumption and transfers related to structural non-employment). With its focus on the composition of fiscal policy, this paper shows a clear relationship to earlier work by Barro (1990), Roeger and De Fiore (1999), Turnovsky (2000), Daveri and Tabellini (2000) and Dhont and Heylen (2005). Whereas Barro (1990) explains only growth, the latter four studies also have endogenous employment.

Empirically, we calibrate our model on actual data and simulate the effects of fiscal policy changes. We find that the model is able to explain a large fraction of the performance differences within Europe and between Europe and the US that we report in Table 1. The Nordic countries perform better than the core euro area mainly thanks to a higher share of productive government expenditures and lower transfers to structurally non-employed people. Furthermore, employment in the Nordic countries benefits from somewhat lower tax rates on labor. Growth is promoted by significantly lower tax rates on capital income. To finance higher productive expenditures and lower capital and labor taxes, the Nordic countries pay lower transfers and collect higher consumption taxes. Our ability to explain important employment and growth differences within Europe is a major contribution of this paper. Most of the existing work either focuses on Europe as a group to be distinguished from the US (e.g. Roeger and De Fiore, 1999; Blanchard, 2004; Alesina et al., 2005; Sapir et al., 2004; Freeman and Schettkat, 2005), or reduces Europe to Germany, France and Italy (e.g. Prescott, 2004; Cardia et al., 2003)[3]. Differences in fiscal policy, in particular much lower tax rates on labor and much lower transfers to structurally non-employed people, can also explain a significant part of the better employment performance of the US compared to Europe. Relatively low productive government expenditures and high taxes on capital income, however, explain why per capita growth in the US is much less outstanding.

It should be clear from the outset that we take fiscal policy differences across countries as given in this paper. We investigate their effects on employment and growth, but we do not try to explain why policy differs. This approach is not unusual in related literature (e.g. Roeger and De Fiore, 1999; Cardia et al., 2003; Prescott, 2004).

The structure of this paper is as follows. In Section 2 we build our model. In Section 3 we calibrate the model on actual data and simulate the effects of changes in the composition of government expenditures and revenues on employment and growth. In Section 4 we compare the predictions of our model with the data. Section 5 of the paper discusses the welfare implications of changes in the composition of fiscal policy, and related differences in employment and growth. Section 6 concludes the paper.

2. Fiscal policy, employment and growth – The model

In this section we investigate the relationship between taxes, government expenditures, employment and growth in a simple endogenous growth framework. Our theoretical model builds on Barro (1990), Turnovsky (2000) and Dhont and Heylen (2005). We extend Turnovsky (2000) by introducing transfers related to structural non-employment. Given ample empirical evidence that transfers related to structural non-employment are a major determinant of (un)employment and growth (see e.g. Blanchard and Wolfers, 2000; Arjona et al., 2002; Nickell et al, 2005; Lindert, 2004), we consider the introduction of such transfers to be a major strength of our model. We improve on our earlier model in Dhont and Heylen

[3] Daveri and Tabellini (2000), Rogerson (2003), Ragan (2004) and Aiginger (2004) also recognize the (better) performance of the Nordic countries. Daveri and Tabellini emphasize the higher degree of coordination or centralisation in Nordic wage bargaining. However, a tendency towards decentralization since the mid 1980s, especially in Denmark and Sweden (OECD, 2004b), may make this explanation less convincing now. Rogerson (2003), Ragan (2004) and Aiginger (2004) also pay attention to the expenditure side of fiscal policy. None of these three studies however explains both employment and growth within a coherent theoretical framework.

(2005) by introducing consumption taxes and by distinguishing capital and labor taxes. As has been demonstrated empirically by Kneller et al. (1999) and Lindert (2004), the precise composition of the tax system may be at least as important as the total tax level.

2.1. Setup of the model

Consider a closed economy consisting of N identical individuals with infinite lives and perfect foresight and N identical perfectly competitive firms. Population remains constant. Assuming an equal number of individuals and firms implies that each firm's output equals per capita output.

Firms

Firms produce output by using physical capital and effective labor. The production function exhibits constant returns to scale, which allows us to focus on a representative firm.

$$y_t = k_t^{1-\beta}(h_t l_t)^{\beta} \quad (1)$$

where y_t, k_t and $h_t l_t$ stand for output per capita, physical capital per capita and effective labor per capita at time t respectively. The evolution of physical capital is determined by the individuals' consumption and saving behavior, to be discussed below. Effective labor depends on hours worked per capita (l_t) and on effective human capital per capita (h_t). Effective human capital increases both in accumulated schooling or training and in the productive efficiency of accumulated schooling. It is our assumption that effective human capital is driven by per capita productive government expenditures (g_{yt}).

$$\dot{h}_t = q g_{yt} \qquad q > 0 \quad (2)$$

with q a constant productivity parameter. Effective human capital is assumed not to depreciate. Obvious components of g_{yt} are education spending, active labor market expenditures, public fixed investment and R&D expenditures. The former two components directly contribute to more human capital being accumulated, the latter two will mainly raise the productive efficiency of accumulated human capital. Individuals and firms take g_{yt} to be exogenous.

Firms hire labor and physical capital up to the point where their marginal products equal the real wage per hour and the real interest rate respectively.

$$w_t = \beta k_t^{1-\beta} h_t^{\beta} l_t^{\beta-1} = \beta h_t \left(\frac{h_t l_t}{k_t} \right)^{\beta-1}$$

$$r_t = (1-\beta) \left(\frac{h_t l_t}{k_t} \right)^{\beta} \tag{3}$$

Individuals

The representative individual's welfare is given by the intertemporal utility function:

$$U = \int_0^{\infty} u(c_t, (1-l_t), G_{ct}) e^{-\rho t} dt \tag{4}$$

where c_t is per capita private consumption at time t, l_t per capita hours worked in the market sector and G_{ct} aggregate government consumption. $\rho > 0$ is the pure rate of time preference. To keep things simple, we normalize the maximum number of hours to one. By consequence, $(1-l_t)$ indicates per capita hours devoted to useful non-market activities and leisure. In what follows we will define l_t as the employment rate.

Following Baxter and King (1993), we further define instantaneous utility as

$$u\left(c_t, \left(1-l_t\right), G_{ct}\right) = \ln(c_t) + a \ln(1-l_t) + \Gamma(G_{ct}) \qquad \text{with } a>0 \tag{5}$$

where the parameter a specifies the relative value of non-market activities and leisure versus private consumption for individual utility. Equation (5) is a form commonly employed in theoretical macroeconomics[4]. Given that under (5) the utility effects of changes in government consumption do not matter for employment and growth, we will not further specify the term $\Gamma(G_{ct})$ until Section 5 where welfare effects are investigated.

Individuals will maximize (4), taking into account (5), subject to the resource constraint

$$\begin{aligned} \dot{k}_t &= (1-\tau_l) w_t l_t + (1-\tau_k) r_t k_t + b_t (1-l_t) - (1+\tau_c) c_t + z_t \\ &= (1-\tau_l) \beta y_t + (1-\tau_k)(1-\beta) y_t + b_t (1-l_t) - (1+\tau_c) c_t + z_t \end{aligned} \tag{6}$$

with k_t the individual's capital holdings, τ_l the tax rate on wage income, τ_k the tax rate on capital income, τ_c the consumption tax rate, b_t a per capita transfer related to non-

[4] Roeger and De Fiore (1999), Cardia et al. (2003) and Prescott (2004) also employ the log-linear specification in private consumption and 'leisure'. However, they omit the term $\Gamma(G_{ct})$. Note that we assume that the marginal utility of private consumption is not affected by public consumption. The existing (mixed) empirical evidence does not go against this assumption (see e.g. Aschauer, 1985; Karras, 1994; Pozzi, 2003).

employment and z_t a lump sum transfer paid by the government. The second line in (6) uses the result, following from (3), that per capita wage and capital income are constant fractions of per capita output. Like human capital, physical capital is assumed not to depreciate.

Government

The government runs a balanced budget. Productive government expenditures, government consumption and transfers are financed by three kinds of taxes. In per capita terms,

$$\begin{aligned} g_{yt} + g_{ct} + z_t + b_t(1-l_t) &= \tau_l w_t l_t + \tau_k r_t k_t + \tau_c c_t \\ &= \tau_l \beta y_t + \tau_k (1-\beta) y_t + \tau_c c_t \end{aligned} \tag{7}$$

Following Turnovsky (2000), we assume that the government claims given fractions of output for productive expenditures and consumption. Algebraically,

$$g_{yt} = \sigma_y y_t,\; g_{ct} = \sigma_c y_t \qquad \text{with } \sigma_y,\, \sigma_c > 0 \tag{8}$$

Transfers related to non-employment are non-productive in our model. They are an unconditional source of income support for inactivity (leisure) and non-market household activities. Although it may seem strange to have such transfers in a model without involuntary unemployment, one can of course analyze their employment and growth effects as a theoretical benchmark case (see also van der Ploeg, 2003). Moreover, there is also clear practical relevance. Unconditional or quasi unconditional benefits related to structurally non-employment are a fact of life in many European countries (see Table 3). In Equation (9) we assume that the government transfer b_t is proportional to after tax per capita wage income according to the replacement rate, v.

$$b_t = v(1-\tau_l) w_t l_t = v(1-\tau_l)\beta y_t \tag{9}$$

Substituting Equations (8) and (9) into (7), we can re-write the budget constraint as:

$$z_t / y_t = \tau_l \beta + \tau_k (1-\beta) + \tau_c \varphi - \sigma_y - \sigma_c - v(1-\tau_l)\beta(1-l_t) \tag{7'}$$

where we define that $c / y = \varphi$.

Optimization

The individual's optimization problem concerns choosing c_t and l_t to maximize lifetime utility, subject to the resource constraint (6) and taking g_{yt}, g_{ct}, z_t, b_t, τ_l, τ_k and τ_c as given. The present value Hamiltonian for this problem is:

$$H_t = \left[\ln(c_t) + a\ln(1-l_t) + \Gamma(G_{ct})\right] e^{-\rho t} + \lambda_t \left[(1-\tau_l) w_t l_t + (1-\tau_k) r_t k_t + b_t(1-l_t) - (1+\tau_c) c_t + z_t\right]$$

The first order conditions yield three equations describing optimal behavior and equilibrium for given g_{yt}, g_{ct}, z_t, b_t τ_l, τ_k and τ_c. After dropping the time subscripts this implies

$$\gamma_c = \frac{\dot{c}}{c} = (1-\tau_k)(1-\beta)\left(\frac{hl}{k}\right)^{\beta} - \rho \tag{10}$$

$$\gamma_k = \frac{\dot{k}}{k} = \left[\beta(1-\tau_l) + (1-\beta)(1-\tau_k) + \frac{b}{y}(1-l) + \frac{z}{y} - (1+\tau_c)\varphi\right]\left(\frac{hl}{k}\right)^{\beta} \tag{11}$$

$$\frac{a}{1-l} = \left[(1-\tau_l)\beta k^{1-\beta} h^{\beta} l^{\beta-1} - b\right]\frac{1}{(1+\tau_c)}\frac{1}{c} \tag{12}$$

Equation (10) is the usual Euler equation for the optimal growth rate of consumption over time γ_c. This equation describes intertemporal optimality. Agents decide to invest more (i.e. to have a higher growth rate of consumption over time) the higher the after tax marginal product of physical capital and the lower the rate of time preference. Equation (11) follows from the household's resource constraint (6) after dividing both sides by *k*, and using the result that $\frac{y}{k} = \left(\frac{hl}{k}\right)^{\beta}$. Equation (12) describes the intratemporal optimality condition between labor (consumption) and 'leisure'. The left hand side of this equation represents the marginal utility of non-employment, the right hand side is the net marginal utility of working. The latter rises in the marginal utility of consumption $(1/c)$ and in the net marginal after-tax consumption possibilities induced by employment $\left[(1-\tau_l)\beta k^{1-\beta} h^{\beta} l^{\beta-1} - b\right]\frac{1}{1+\tau_c}$.

In order to find equilibrium growth and employment rates in terms of the parameters of the model, we first re-write Equation (2) using that $g_y = \sigma_y y$. This yields an equation for the growth rate of effective human capital

$$\frac{\dot{h}}{h} = \gamma_h = q\sigma_y \frac{y}{h} = q\sigma_y l\left(\frac{hl}{k}\right)^{\beta-1}$$

from which we can derive an expression for $(hl/k)^{\beta}$.

$$\left(\frac{hl}{k}\right)^{\beta} = \left[\frac{ql\sigma_y}{\gamma_h}\right]^{\beta/(1-\beta)} \tag{13}$$

Next, using (9) we can re-write the intratemporal optimality condition (12) as an equation for $c/y = \varphi$.

$$\frac{c}{y} = \varphi = \beta \frac{1}{a} \frac{(1-l)}{(1+\tau_c)} \left[\frac{(1-\tau_l)}{l} - v(1-\tau_l) \right] \tag{14}$$

Our final equation for intertemporal optimality (15) follows from substituting Equation (13) into the Euler equation (10). Substituting Equations (7'), (9), (13) and (14) into Equation (11) yields Equation (16) which is consistent with intratemporal optimality, private agents' resource constraint and government budget balance.

$$\gamma_c = (1-\tau_k)(1-\beta) \left[\frac{q l \sigma_y}{\gamma_h} \right]^{\beta/(1-\beta)} - \rho \tag{15}$$

$$\begin{aligned} \gamma_k &= \left(\frac{hl}{k} \right)^{\beta} \left[(1-\sigma_y-\sigma_c) - \varphi \right] \\ &= \left[\frac{q l \sigma_y}{\gamma_h} \right]^{\beta/(1-\beta)} \left[(1-\sigma_y-\sigma_c) - \beta \frac{1}{a} \frac{(1-l)}{(1+\tau_c)} \left(\frac{(1-\tau_l)}{l} - v(1-\tau_l) \right) \right] \end{aligned} \tag{16}$$

Since along the economy's balanced growth path the growth rates of per capita consumption, output, physical capital and human capital are all equal ($\gamma_c = \gamma_k = \gamma_y = \gamma_h$), Equations (15) and (16) allow us to determine the equilibrium values of γ and l, consistent with individual optimization, firm optimization and the government budget constraint. We will solve the model numerically for realistic parameterizations. We discuss the choice of these parameters in the next section.

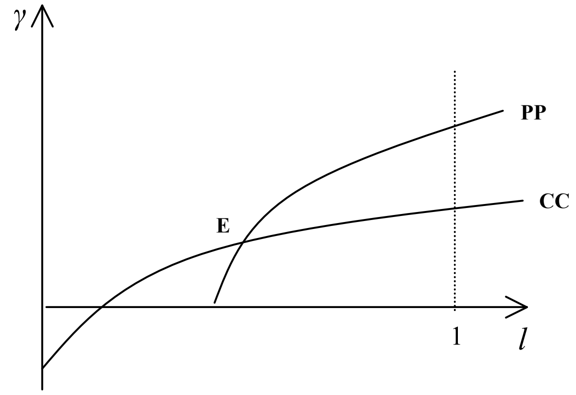
3. The impact of fiscal policy on equilibrium employment and growth

We first discuss the theoretical effects of fiscal policy in general. We focus on the effects of changes in fiscal policy financed by changes in lump sum transfers. Then we calibrate our model on actual data and numerically simulate it. Numerical simulation illuminates the relative size of the effects of various policy measures, both when financed by changes in lump sum transfers and by changes in other policy variables. It also allows us to investigate the influence of the initial level of policy parameters on the effects from changing them. We compare fiscal policy effects starting from current parameters in the core euro area and in the US as alternative benchmarks.

Theoretical effects

Equations (15) and (16) and the balanced growth condition that $\gamma_c = \gamma_k = \gamma_h = \gamma_y$ imply two equilibrium loci in an employment-growth framework (see Figure 1). The CC locus reflects Equation (15), the PP locus Equation (16). It can easily be shown that both loci are nonlinear and upward sloping. For realistic parameter values a unique employment-growth equilibrium will always exist. Realistic parameter values make the PP locus steeper than the CC locus and its intercept on the horizontal axis higher. Initial equilibrium is situated at point E. Changes in fiscal policy affect employment and growth by shifting either one or both of the equilibrium loci. Here we focus on the effects of changes in fiscal policy financed by changes in lump sum transfers. For mathematical proof of the sign of these effects we refer to Appendix 1.

Figure 1. Equilibrium in an employment-growth framework



An increase in any of the tax rates, with revenues rebated in lump sum fashion, has a negative effect on both equilibrium growth and employment.

$$\frac{\partial \gamma}{\partial \tau_i} < 0 \qquad \frac{\partial l}{\partial \tau_i} < 0 \qquad i = k, l, c$$

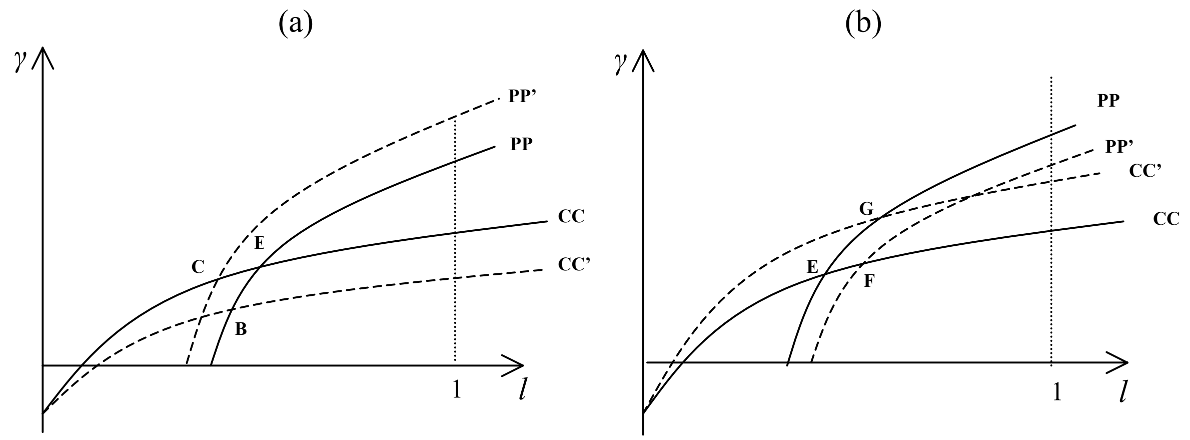
An increase in the tax rate on capital income reduces the growth rate by reducing the net return on physical capital, for given employment. Agents will invest less. In Figure 2(a) this results in a downward rotation of the CC-locus. The decrease in investment reduces the ratio of physical to effective human capital, which has a negative effect on the productivity of labor and the return to working. Agents will work less. Since lower employment causes an additional decline in the return on physical capital investment, the growth rate will fall further. A new long-run equilibrium with lower employment and growth will be reached in B, along the original PP locus.

An increase in the tax rate on consumption or on labor income negatively affects the employment rate by reducing the net marginal return to working, for given growth. Agents will work less. In Figure 2(a) this results in a leftward shift of the PP-locus. Since lower employment implies a reduction of the net return on physical capital, investment and growth will also fall. Along the lines discussed above, the reduction in investment will further discourage labor supply and employment. A new long-run equilibrium will be reached in C.

The effects of an increase in the transfer replacement rate v are qualitatively identical to those of an increase in the consumption or labor income tax rate depicted in Figure 2(a). Equilibrium also moves from E to C.

$$\frac{\partial \gamma}{\partial v} < 0 \qquad \frac{\partial l}{\partial v} < 0$$

Figure 2. Fiscal policy shocks in an employment-growth framework



An increase in either government consumption or productive expenditures, financed by lump sum taxation, can be shown to have a positive effect on equilibrium growth and employment. For government consumption this result is unambiguous. For productive government expenditures it is the most likely outcome, as our simulations in the next section show. Here we concentrate on this (positive) result.

$$\frac{\partial \gamma}{\partial \sigma_i} > 0 \qquad \frac{\partial l}{\partial \sigma_i} > 0 \qquad i = c, y$$

Higher government consumption raises the employment rate due to a negative wealth effect. The PP locus shifts to the right, the CC locus is unaffected. The positive effect of higher employment on the return to investment in physical capital causes growth to rise also. The economy in Figure 2(b) moves from E to F. An increase in productive government expenditures unambiguously shifts the CC locus upwards. Higher productive expenditures imply an increase in effective human capital, which raises the return to investment in physical capital. Investment and growth go up. For a given PP locus, employment rises also. The effect of higher productive expenditures on the PP locus itself is ambiguous. On the one hand, higher productive expenditures imply a reduction of lump sum transfers, which encourages agents to work more due to a negative wealth effect (PP shifts to the right). On the other hand, productive expenditures promote human capital and per capita output for given employment, which implies a counteracting positive wealth effect (PP shifts to the left). If we assume in Figure 2(b) that the PP locus remains unchanged, the economy will move from E to G. Even if PP moves after an increase in productive government expenditures, it would require a very strong (and unrealistic) shift to the left for a new equilibrium to result with lower employment.

Parameters

In order to find numerical solutions for our model, we have chosen specific values for the parameters. Following among others Barro (1990), the time preference rate ρ has been set equal to 0.02. With respect to physical capital, we assume a capital-share coefficient $(1-\beta)$ equal to 0.4. The productivity parameter q and the relative weight of 'leisure' versus consumption in the felicity function a are determined by calibration. We have calibrated values for these parameters such that with observed average levels of transfer replacement rates, tax rates and government expenditures in the core countries of the euro area (see Table 3), the model correctly predicts the average of these countries' employment and growth rates in 1995-2004 (employment in hours). The weight of 'leisure' in the felicity function a has been set at 0.26, the productivity parameter q at 0.11. Our calibrated value for a is very low compared to the value of 1.54 assigned to this parameter by Prescott (2004). Turnovsky (2000), however, assigns a relative weight of 0.3 to 'leisure'. Moreover, Prescott's choice of a high relative weight of 'leisure' is one of the elements underlying the criticism that the elasticity of hours worked with respect to the wage and with respect to taxes is excessively high in his study (Alesina et al., 2005).

Numerical effects

Starting from budget balance, we impose fiscal policy shocks equal to 3% of initial output, i.e. output before any changes in employment or growth have taken place. We consider reductions in the tax rates and in the transfer replacement rate, and increases in government expenditures. All shocks are therefore expected to increase output and growth. Table 2 contains the results. The choice of 3% is arbitrary. Smaller or larger shocks would generate similar results as far as the direction and the relative size of effects is concerned. Our benchmark against which all policy shocks are evaluated in Table 2, is the average current situation in the core euro area countries (see note below Table 2).

The upper part of Table 2 considers shocks that are financed by lump sum transfers to maintain budget balance. The lower part assumes shocks that are compensated by a change in another fiscal policy variable. In our discussion we focus on the main findings. Key variables are the tax rate on labor (τ_l), the transfer replacement rate (v), the share of productive government expenditures (σ_y) and the tax rate on capital (τ_k). As becomes clear from the upper part of the table, 'positive' shocks to each of these variables raise both employment and growth. There are significant differences, though. Shocks to τ_l and v have the strongest effects on employment, shocks to σ_y and τ_k are dominant in their effect on growth. The underlying causal mechanisms are obvious from our discussion of Figure 2. Changes in the tax rate on consumption and changes in government consumption also matter for employment and growth, although to a lesser extent.

Table 2. Fiscal shocks in the model (equal to 3% of output) [a]

Compensated by a change in lump sum transfers						
	$\Delta\tau_l = -5.4$	$\Delta\tau_k = -7.5$	$\Delta\tau_c = -5.1$	$\Delta\sigma_y = +3$	$\Delta\sigma_c = +3$	$\Delta v = -16.2$
Effect on employment Effect on growth Ex-post effect on lump sum transfers	$\Delta l = +2.7$ $\Delta\gamma = +0.07$ $\Delta(z/y) = -3.8$	$\Delta l = +0.6$ $\Delta\gamma = +0.13$ $\Delta(z/y) = -3.2$	$\Delta l = +1.0$ $\Delta\gamma = +0.03$ $\Delta(z/y) = -3.1$	$\Delta l = +1.5$ $\Delta\gamma = +0.45$ $\Delta(z/y) = -3.4$	$\Delta l = +1.1$ $\Delta\gamma = +0.03$ $\Delta(z/y) = -3.3$	$\Delta l = +2.4$ $\Delta\gamma = +0.06$ $\Delta(z/y) = +2.3$

Compensated by a change in another fiscal policy variable, indicated vertically						
Changing : **Compensating** [b] **:**	$\Delta\tau_l = -5.4$	$\Delta\tau_k = -7.5$	$\Delta\tau_c = -5.1$	$\Delta\sigma_y = +3$	$\Delta\sigma_c = +3$	$\Delta v = -16.2$
$\Delta\tau_l$	-	$\Delta\tau_l = 4.6$ $\Delta l = -1.9$ $\Delta\gamma = +0.05$	$\Delta\tau_l = 4.5$ $\Delta l = -1.5$ $\Delta\gamma = -0.04$	$\Delta\tau_l = 4.9$ $\Delta l = -1.2$ $\Delta\gamma = +0.37$	$\Delta\tau_l = 4.7$ $\Delta l = -1.5$ $\Delta\gamma = -0.04$	$\Delta\tau_l = -3.4$ $\Delta l = +4.2$ $\Delta\gamma = +0.11$
$\Delta\tau_k$	$\Delta\tau_k = 8.9$ $\Delta l = +1.8$ $\Delta\gamma = -0.09$	-	$\Delta\tau_k = 7.6$ $\Delta l = +0.4$ $\Delta\gamma = -0.11$	$\Delta\tau_k = 8.0$ $\Delta l = +0.8$ $\Delta\gamma = +0.28$	$\Delta\tau_k = 7.8$ $\Delta l = +0.4$ $\Delta\gamma = -0.11$	$\Delta\tau_k = -5.3$ $\Delta l = +2.9$ $\Delta\gamma = +0.16$
$\Delta\tau_c$	$\Delta\tau_c = 6.2$ $\Delta l = +1.5$ $\Delta\gamma = +0.04$	$\Delta\tau_c = 5.3$ $\Delta l = -0.4$ $\Delta\gamma = +0.10$	-	$\Delta\tau_c = 6.0$ $\Delta l = +0.4$ $\Delta\gamma = +0.42$	$\Delta\tau_c = 5.7$ $\Delta l = 0.0$ $\Delta\gamma = 0.0$	$\Delta\tau_c = -3.7$ $\Delta l = +3.2$ $\Delta\gamma = +0.08$
$\Delta\sigma_y$	$\Delta\sigma_y = -3.3$ $\Delta l = +0.9$ $\Delta\gamma = -0.48$	$\Delta\sigma_y = -2.7$ $\Delta l = -0.9$ $\Delta\gamma = -0.34$	$\Delta\sigma_y = -2.9$ $\Delta l = -0.5$ $\Delta\gamma = -0.45$	-	$\Delta\sigma_y = -2.9$ $\Delta l = -0.5$ $\Delta\gamma = -0.44$	$\Delta\sigma_y = +2.0$ $\Delta l = +3.5$ $\Delta\gamma = +0.37$
$\Delta\sigma_c$	$\Delta\sigma_c = -3.4$ $\Delta l = +1.5$ $\Delta\gamma = +0.04$	$\Delta\sigma_c = -2.9$ $\Delta l = -0.4$ $\Delta\gamma = +0.10$	$\Delta\sigma_c = -3.0$ $\Delta l = 0.0$ $\Delta\gamma = 0.0$	$\Delta\sigma_c = -3.1$ $\Delta l = +0.4$ $\Delta\gamma = +0.42$	-	$\Delta\sigma_c = +2.0$ $\Delta l = +3.2$ $\Delta\gamma = +0.08$
Δv	$\Delta v = -25.7$ $\Delta l = +6.7$ $\Delta\gamma = +0.17$	$\Delta v = -23.6$ $\Delta l = +4.2$ $\Delta\gamma = +0.23$	$\Delta v = -23.4$ $\Delta l = +4.6$ $\Delta\gamma = +0.12$	$\Delta v = -25.7$ $\Delta l = +5.5$ $\Delta\gamma = +0.58$	$\Delta v = -24.6$ $\Delta l = +4.8$ $\Delta\gamma = +0.13$	-

[a] All changes in fiscal policy variables and changes in employment (in hours) and growth are changes in percentage points compared to the benchmark where $\gamma = 1.74$, $l = 49.8$, $\tau_l = 57.8$, $\tau_k = 41.1$, $\tau_c = 13.6$, $\sigma_y = 9.38$, $\sigma_c = 16.3$, $v = 51.6$. These values correspond to the average of the core euro area countries' situation in 1995-2001.

[b] The upper line in each rectangle indicates the precise size of the compensation.

The lower part of Table 2 shows the effects of 'budget neutral' combined fiscal policy shocks, which are likely to be more realistic experiments. Again, we focus on the most striking results. The most effective policy adjustments always seem to involve cuts in the transfer replacement rate (see utter right column). The employment rate always rises by at least 2.9 percentage points. The increase in employment is the strongest when the cut in v is combined with lower taxes on labor (+4.2 percentage points). Very effective also in raising employment is the combination of lower v with an increase in productive government expenditures. The employment rate rises by 3.5 percentage points. Moreover, this fiscal policy readjustment is among the most effective in promoting growth (+0.37 percentage points). The combined success for both employment and growth of reducing v and raising σ_y fully confirms our earlier results in Dhont and Heylen (2005). In line with the results in the upper part of Table 2, reducing taxes on labor again shows up as one of the more effective ways to stimulate employment. Reducing the transfer replacement rate is clearly the more efficient way to finance the reduction in labor taxes. Alternative ways to finance this reduction, either affect growth ($\Delta\tau_k$), or reduce the positive employment effect ($\Delta\tau_c$, $\Delta\sigma_c$), or do both ($\Delta\sigma_y$).

Putting growth first, it is clear from our results that the fraction of productive government expenditures has to rise. The more efficient way to finance this is again reducing v, as has been emphasized before. Alternative ways to finance the increase in productive expenditures either reduce the positive employment effect ($\Delta\tau_c$, $\Delta\sigma_c$), or reduce the growth effect ($\Delta\tau_k$), or reduce both ($\Delta\tau_l$). Reducing capital taxes also contributes to higher growth. Except in the case of lowering the transfer replacement rate, however, the need to finance this reduction in capital taxes always seems to be harmful to employment.

In Appendix 2 we present comparable results obtained from simulating the same policy shocks, but starting from US fiscal parameters as benchmark. The main differences for government revenue are that initial tax rates on labor and tax rates on consumption are much lower in the US. As to government expenditures, consumption and transfers to the non-employed are much lower (see Table 3 below). These alternative simulations confirm all the above results on the sign and the relative effectiveness of different fiscal policy changes. Starting from the US benchmark, the predicted size of these effects is generally similar also, except for labor taxes. Changing labor taxes from a lower initial level clearly exerts smaller effects, which confirms the idea that the distortive impact of labor taxes rises in their level.

Summarizing, the more efficient composition of fiscal policy from an employment and growth perspective would seem to include lower taxes on labor and – especially – higher productive government expenditures, financed by a reduction in transfers to structurally non-employed people. Among the other ways to finance a reduction in labor taxes and an increase in productive expenditures, higher consumption taxes (or lower government consumption) would be preferable if one attaches priority to growth. Higher capital taxes would be advisable if one attaches priority to employment. In Section 5 we will evaluate these policy changes from a welfare perspective.

4. Predicted versus actual employment and growth in Europe and the US

In this section we test the ability of our model to explain the cross-country employment and growth differences that we have reported in Table 1. We first briefly describe relevant fiscal policy data and then we assess the explanatory power of the model.

Description of the fiscal policy data

Table 3 describes key characteristics of fiscal policy in 1995-2001. All reported data are averages of the available annual data in that period. Appendix 3 contains more details. In our discussion here we focus on the core countries of the euro area, the Nordic countries, the US and the UK.

Table 3. Fiscal policy in Europe and the US (1995-2001)

	tax rate on labor income (%)$^{\alpha}$	Tax rate on capital income (%)$^{\beta}$	consumption tax rate (%)$^{\alpha}$	productive government expenditures (% of GDP)$^{\delta}$	government consumption (% of GDP)$^{\eta}$	net transfer replacement rate (%)$^{\lambda}$
Proxy for :	τ_l	τ_k	τ_c	σ_y	σ_c	v
Core euro area						
Austria	56.2	34.0	13.2	9.1	14.0	62.3
Belgium	67.4	40.2	13.4	8.3	17.9	60.2
France	50.6	38.7	17.1	11.1	18.3	52.2
Germany	61.8	52.5	11.1	8.7	15.3	61.5
Netherlands	54.5	35.0	12.2	10.3	18.1	44.8
Italy	56.1	46.1	14.7	8.9	14.1	28.5[a]
Average	**57.8**	**41.1**	**13.6**	**9.4**	**16.3**	**51.6**
Nordic countries						
Finland	59.4	27.9	15.2	11.8	16.1	62.3
Denmark	50.8	32.9	18.9	12.4	18.4	39.8
Norway	46.4	28.0	16.4	12.2	14.7	23.2
Sweden	51.5	28.0	17.9	13.5	20.6	37.8
Average	**52.0**	**29.2**	**17.1**	**12.5**	**17.5**	**40.8**
EU convergence						
Spain	45.0	35.0	10.9	9.1	13.5	21.67
Portugal	39.6	37.7	13.4	10.8	13.8	35.33
Ireland	42.5	10.0	16.4	10.2	12.5	63.33
Average	**42.4**	**27.6**	**13.5**	**10.0**	**13.3**	**40.11**
US	**34.7**	**39.3**	**7.2**	**9.6**	**9.8**	**15.3**
Switzerland	36.4	34.1	2.9	8.8	6.3	45.3
UK	39.4	31.1	14.5	7.3	14.6	40.8

Notes: A description of all variables is given in the main text. For more details on calculation and underlying assumptions, see Appendix 3. [a] The net transfer replacement rate in Italy has been set equal to the average in Spain and Portugal (see motivation in footnote 4).

Sources: $^{\alpha}$ OECD (2005), Financial and Fiscal Affairs, Taxing Wages; $^{\beta}$ Devereux et al. (2002) and Institute for Fiscal Studies (www.ifs.org.uk/publications.php). Data for Denmark have been taken from Danish Ministry of Taxation, http://www.skm.dk/ and KPMG Corporate Tax Rate Survey; $^{\delta}$ See appendix 3; $^{\eta}$ OECD (2005), Economic Outlook; $^{\lambda}$ OECD, Tax-Benefit models. Data kindly provided by D. Paturot (OECD).

The core euro area countries have the highest marginal tax rates on labor, the highest tax rates on capital income and moderate tax rates on consumption. The Nordic countries also have high tax rates on labor (above 50% on average). Moreover, they have the highest consumption taxes. Taxes on capital income, however, are among the lowest in the Nordic countries. The tax system in the US is remarkable in its combination of very low tax rates on labor and – especially – consumption, but relatively high tax rates on capital income. Tax rates in the UK are moderate in each category.

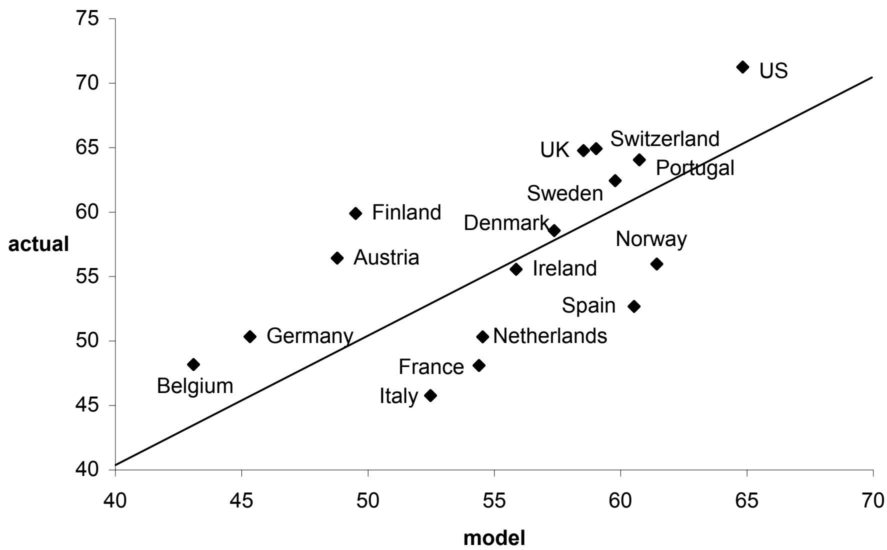
Governments in the Nordic countries allocate by far the highest fractions of output to productive expenditures. Productive expenditures in percent of GDP are the lowest in the UK.

The US and the core countries of the euro area take intermediate positions. Government consumption in percent of GDP is the highest also in the Nordic countries, followed at close distance by the core euro area on average. In the US, government consumption is (much) lower. A final variable in Table 3 is our proxy for the net transfer replacement rate related to structural non-employment. The core countries of the euro area pay the highest net transfers on average. In each country v is (much) higher than 40%. The only exception is Italy[5]. In the Nordic countries the transfer replacement rate is below 40%, with now Finland being the only exception. Transfers to structurally non-employed people are by far the lowest in the US.

Explaining employment and growth differences

Using the fiscal policy data of Table 3, Figures 3 and 4 now assess the explanatory power of our model for all countries in our sample. Figure 1 depicts predicted and actual employment rates in hours. Actual employment rates are averages for 1995-2004. Predictions are based on the parameter values for β, ρ, a and q as mentioned above and on true values for the fiscal policy variables τ_l, τ_k, τ_c, σ_y, σ_c and v in 1995-2001.

Figure 3. Employment rates in hours in individual countries, in %, 1995-2004

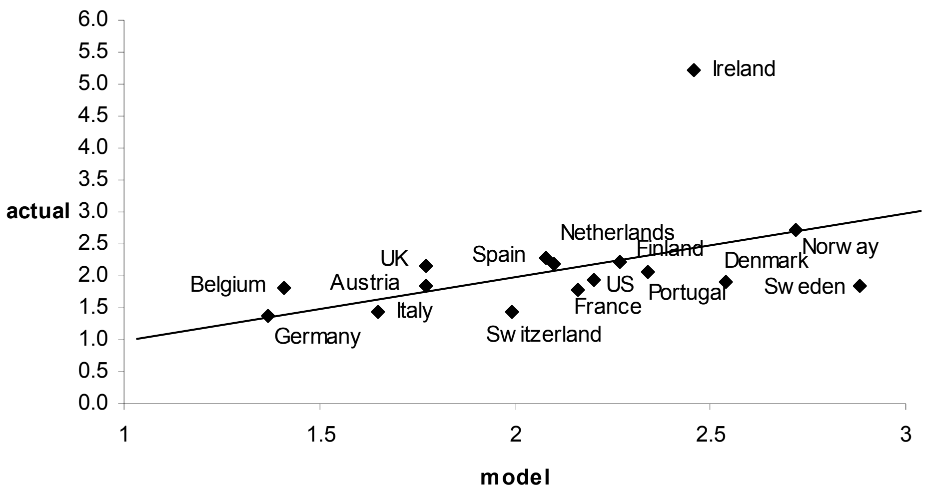


Notes: - The added solid line is the 45°-line

[5] Original data provided by the OECD show a net replacement rate in Italy equal to 17%. However, as shown by Reyneri (1994), the gap between Italy and the other European countries is much smaller than it seems. Although unemployment benefits barely exist in Italy, this does not imply a zero fall-back position. Reyneri (1994) points to the importance of family support as an alternative to unemployment benefits. Furthermore, he emphasizes the existence of invalidity benefits as an additional mechanism of public transfers that the unemployed could receive. To correct for this, we have set the net replacement rate in Italy equal to the average net replacement rate in the two other Southern European countries, Spain and Portugal.

Correlation in Figure 3 is quite strong (R=0.64). Our model correctly predicts the highest employment rate in the US and a relatively strong employment performance in the Nordic countries and the UK in comparison with the core countries of the euro area. The rather poor employment performance of the latter group of countries is also correctly predicted by our model. Clearly, these results support the hypothesis that our model – with the imposed parameter values – is capable of explaining structural differences in the employment rates across countries. Moreover, all countries are reasonably close to the 45°-line. Only for Finland and Spain the gap is bigger than 7 percentage points.

Figure 4. Per capita potential growth rates in individual countries, in %, 1995-2004



<u>**Notes:**</u> - The added solid line is the 45°-line

Our model does a rather good job also in explaining per capita potential growth. Correlation in Figure 4 between actual growth in 1995-2004 and predicted growth is 40%. Our model correctly predicts a relatively strong growth performance in the Nordic countries and, to a lesser extent, in the US in comparison with the core countries of the euro area. With the exception of Ireland, Switzerland, Sweden and Denmark, all countries are within a band of 0.4 percentage points from the 45°-line. The distance for Denmark and Switzerland remains below 0.65 percentage points, for Sweden it is 1 percentage point. Our model has clearly the biggest difficulty explaining growth in Ireland. Considering recent work by Honohan and Walsh (2002), however, we should not take this difficulty too seriously. Honohan and Walsh point to the exceptional - and unlikely to be repeated - nature of the very high Irish growth in the second half of the 1990s. In line with this, OECD data for the more recent period 2002-05 reveal an average annual per capita potential growth rate of 'only' 3.5 percent. Disregarding Ireland, correlation in Figure 4 rises to 54%.

Our predictions in Figures 3 and 4 are based on parameter values for *a* and *q* calibrated such that our model correctly predicts the average of the core euro area countries' employment and growth rates in 1995-2004. As a robustness test we have alternatively calibrated the values for *a* and *q* on the average of the Nordic countries' employment and growth rates, and on the employment and growth rate of the US. Obviously, the (minor) changes in the values for *a* and *q*[6] implied by these alternative calibrations affect the position of the individual countries around the 45°- line. However, compared to our results in Figures 3 and 4, the correlation between predicted and actual employment or growth rates hardly changes, which again confirms the good explanatory power of our model.

Reconsidering our results the difference in the employment and growth performance of the European countries can now be explained. The Nordic countries do better both in terms of employment and growth mainly thanks to a higher share of productive government expenditures and lower transfers to structurally non-employed people. Moreover, taxes on labor are slightly lower, on average, which is also good for employment. And taxes on capital are lower, which is beneficial to growth. To finance higher σ_y, lower τ_k and slightly lower τ_l, the Nordic countries pay lower transfers v and collect higher consumption taxes τ_c. The only case where this explanation is harder to impose, seems to be employment in Finland. Despite a high transfer replacement rate, and relatively high taxes on labor, employment in Finland is far better than the European average (Table 1).

Considering that the US have the lowest tax rates on labor and the lowest transfer replacement rates for structurally non-employed people, our results can also explain the very high employment in this country. Growth in the US is much less outstanding, due to high taxes on capital and relatively low productive expenditures.

5. Welfare implications

What are the welfare implications for the representative individual of the policies that seem most efficient in promoting employment and growth? Will welfare increase as well? Or is lower employment not necessarily sub-optimal, as suggested by Blanchard (2004)? To quantify welfare, we now first have to specify the term $\Gamma(G_{ct})$ in the individual's utility function. It should be recognized, though, that the existing literature provides very little guidance here. We choose to follow Turnovsky (2000) in assigning the same relative weight to government consumption and to 'leisure'. Furthermore, we adopt a logarithmic functional form, which is consistent with our specification for private consumption (see also Park and Philippopoulos, 2004). If for the sake of simplicity we normalize constant population N to 1, the individual's instantaneous utility function can be written as:

[6] Calibrating on the average for the Nordic countries implies a=0.23 and q=0.08. Calibrating on the US yields a=0.19 and q=0.08.

$$u(c_t, 1-l_t, G_{ct}) = \ln(c_t) + a\ln(1-l_t) + a\ln(\sigma_c y_t) \quad (5')$$

where we also use Equation (8). Starting from (5') we derive in Appendix 4 the representative individual's equilibrium welfare level, i.e. his optimized lifetime utility. Equation (17) shows the result.

$$U = \frac{\ln(c_0)}{\rho} + \frac{(1+a)\gamma}{\rho^2} + \frac{a\ln(1-l)}{\rho} + \frac{a\left(\ln(\sigma_c) + \ln(y_0)\right)}{\rho} \quad (17)$$

In this equation c_0 and y_0 stand for initial consumption and income, respectively. To calculate them we assume initial physical and effective human capital stocks equal to 1 in each country (see Appendix 4). Using the fiscal policy data discussed before, our model predicts relatively high individual lifetime utility in the Nordic countries and the US in comparison with the core countries of the euro area. Our model therefore not only predicts higher employment and growth, but also higher welfare in the euro area countries if they allocated more resources to productive government expenditures, lowered taxes on labor income and reduced transfers related to structural non-employment.

Table 4 tells a similar story. We report the welfare implications of the fiscal policy shocks described in the bottom part of Table 2. As can be seen, from a welfare perspective increases in productive government expenditures seem by far the most advisable, especially when they are financed by a reduction of transfers related to structural non-employment, or by an increase in taxes on capital income. Reducing taxes on labor also promotes welfare except when this reduction is financed by cutting productive expenditures. Policies that reduce taxes on capital income seem the least beneficial to welfare. Despite its relative effectiveness in promoting employment and growth, reducing the transfer replacement rate contributes much less to welfare. The reason is obviously that agents cut back on leisure and useful non-market activities.

TABLE 4 Effects of a fiscal policy stimulus on welfare [a]

Fiscal policy shock, compensated by a change in another fiscal policy variable, indicated vertically						
Changing : **Compensating :**	$\Delta\tau_l = -5.4$	$\Delta\tau_k = -7.5$	$\Delta\tau_c = -5.1$	$\Delta\sigma_y = +3$	$\Delta\sigma_c = +3$	$\Delta v = -16.2$
$\Delta\tau_l$	-	ΔU= -4.6	ΔU= -1.5	ΔU= +13.0	ΔU= -1.8	ΔU= +4.1
$\Delta\tau_k$	ΔU= +5.3	-	ΔU= +3.3	ΔU= +17.7	ΔU= +3.3	ΔU= +1.1
$\Delta\tau_c$	ΔU= +1.5	ΔU= -3.0	-	ΔU= +14.9	ΔU= 0.0	ΔU= +3.2
$\Delta\sigma_y$	ΔU = -18.1	ΔU= -19.4	ΔU= -17.0	-	ΔU= -16.6	ΔU= +13.5
$\Delta\sigma_c$	ΔU= +1.0	ΔU= -3.2	ΔU= 0.0	ΔU= +14.7	-	ΔU= +3.1
Δv	ΔU= +6.5	ΔU= +1.8	ΔU= +4.5	ΔU= +20.8	ΔU= +4.5	-

[a] All changes in fiscal policy variables are changes in percentage points compared to the benchmark where τ_l = 57.8, τ_k =41.1, τ_c = 13.6, σ_y = 9.38, σ_c = 16.3, v = 51.6. These values correspond to the average of the core euro area countries' situation in 1995-2001. The benchmark welfare level equals U=-98. Changes in welfare are changes in levels.

6. Conclusions

In recent years, researchers have paid growing attention to the widening gap in macroeconomic performance at both sides of the Atlantic. This paper emphasizes the role of the composition of fiscal policy. Our contribution consists of (i) explaining both employment and growth differences within one coherent framework and (ii) clarifying 'within European differences' between the core countries of the euro area and the Nordic countries.

Our main results are as follows. Our model identifies taxes on labor income and transfers related to structural non-employment as dominant fiscal policy variables explaining the evolution of (and cross-country differences in) employment. Dominant variables explaining the evolution of growth are the share of productive government expenditures and taxes on capital income. Productive government spending is furthermore identified as a third important variable driving employment. The predictions of our model strongly match true observations. The Nordic countries perform better than the core euro area countries mainly thanks to a higher share of productive government expenditures and lower transfers to the structurally non-employed. Moreover, taxes on labor are slightly lower on average, which is also relatively good for employment. Finally, growth in the Nordic countries benefits from lower taxes on capital. To finance higher productive expenditures and lower capital and labor taxes, the Nordic countries pay lower transfers and collect higher consumption taxes. Our model is also able to explain the employment success of the US compared to Europe. Much lower tax rates on labor and much lower transfers related to structural non-employment seem to make the difference. Relatively low productive government expenditures and high taxes on capital income, however, explain why per capita growth in the US is much less outstanding.

The policy implication of our results is important for the European welfare states. Our research provides a clear indication that low employment and growth levels in the core countries of the euro area are strongly related to the composition of fiscal policy. Thinking about employment and growth promotion, priority should be to reduce the (structural non-employment) transfer replacement rate and to allocate the resources saved to productive government expenditures. In second order, employment and growth will benefit from reducing tax rates on labor and capital. These policy changes may also be welfare improving in the longer run.

References

AGHION, P. and P. HOWITT, 2005, “Appropriate growth policy : A unifying framework”, *2005 Joseph Schumpeter Lecture*, 20th Annual Congress of the European Economic Association, Amsterdam.

AIGINGER, K., 2004, “The three tier strategy followed by successful European countries in the 1990s”, *International Review of Applied Economics*, 18, p. 399-422.

ALESINA A. , GLAESER E. and SACERDOTE B., 2005, “Work and leisure in the US and Europe: Why so different?”, *NBER Working Paper*, no 11278

ARJONA R., LADAIQUE M. and PEARSON M., 2002, “Social protection and growth”, *OECD Economic Studies*, 35, p. 7-45

ASCHAUER A.D., 1985, “Fiscal policy and aggregate demand”, *American Economic Review*, 75, p. 117-127.

BARRO R.J., 1990, “Government spending in a simple model of endogenous growth”, *Journal of Political Economy*, 98, S103-S125

BLANCHARD O., 2004, “The economic future of Europe”, *NBER Working Paper*, no 10310

BLANCHARD O. and WOLFERS J., 2000, “The role of shocks and institutions in the rise of European unemployment: The aggregative evidence”, *Economic Journal*, 110, p. C1-C33

CAPOLUPO R., 2000, “Output taxation, human capital and growth”, *The Manchester School*, 68, p. 166-183

CARDIA E., KOZHAYA N. and RUGE-MURCIA F.J, 2003, “Distortionary taxation and labor supply”, *Journal of Money, Credit and Banking*, 35, p. 351-373

DAVERI F. and TABELLINI G., 2000, “Unemployment, growth and taxation in industrial countries”, *Economic Policy*, 30, p. 49-104.

DENIS C., MC MORROW K., ROEGER W. and VEUGELERS R., 2005, “The Lisbon Strategy and the EU’s structural productivity problem”, *European Economy – Economic Papers*, N° 221.

DEVEREUX M.P., GRIFFITH R. and KLEMM A., 2002, “Corporate income tax reforms and international tax competition”, *Economic Policy*, 35, p. 451-495.

DHONT T. and HEYLEN F., 2005, “Fiscal policy, employment and growth : Why is the Euro area lagging behind”, Paper presented at the 20th Annual Congress of the European Economic Association, Amsterdam (www.sherppa.be).

EDERVEEN S., DE GROOT H.L.F. and NAHUIS R., 2006, “Fertile soil for structural funds? A panel data analysis of the conditional effectiveness of European cohesion policy”, *Kyklos*, 59, p. 17-42.

FREEMAN R.B. and SCHETTKAT R., 2005, “Marketization of household production and the EU-US gap in work”, *Economic Policy*, January, p. 6-50.

HONOHAN, P. and WALSH B., 2002, “Catching up with the leaders: The Irish hare”, *Brookings Papers on Economic Activity*, 1, p. 1-57.

KARRAS G., 1994, “Government spending and private consumption: some international evidence”, *Journal of Money Credit and Banking*, 26, p. 9-22.

KNELLER R., BLEANEY M.F. and GEMMELL N., 1999, “Fiscal policy and growth: evidence from OECD countries”, *Journal of Public Economics*, 74, p. 171-190.

LINDBECK A., 1982, “Tax effects versus budget effects on labor supply”, *Economic Inquiry*, 20, 473-489.

LINDERT P.H., 2004, *Growing Public – Social Spending and Economic Growth Since the Eighteenth Century*, Cambridge: Cambridge University Press.

NICKELL S., NUNZIATA L. and OCHEL W., 2005, "Unemployment in the OECD since the 1960s. What do we know?", *Economic Journal*, 115, p. 1-27

NICOLETTI, G. and SCARPETTA S., 2003, "Regulation, productivity and growth : OECD evidence", *Economic Policy*, April, p. 9-72.

NICOLETTI, G. and SCARPETTA S., 2005, "Product market reforms and employment in OECD countries", *OECD Economics Department Working Paper*, N° 472.

OECD, 2001, *Employment outlook*, Paris: OECD

OECD, 2002, *Employment outlook*, Paris: OECD

OECD, 2003, *Education at a glance 2003 – Tables*, www.oecd.org/edu/eag2003

OECD, 2004a, *Education at a glance 2004 – Tables*, www.oecd.org/edu/eag2004

OECD, 2004b, "Wage setting institutions and outcomes", *Employment Outlook*, p. 127-181.

OECD, 2004c, *Benefits and wages,* country specific files, www.oecd.org/els/social/workincentives

OECD, 2005, Statistical Compendium on CD-rom, 2005-II

OLOVSSON C., 2004, "Why do Europeans work so little", Seminar Paper, Institute for International Economic Studies, Stockholm University, n° 727.

POZZI L., 2003, "Tax discounting in a high debt economy", *Oxford Bulletin of Economics and Statistics*, 65, p. 261-282.

PRESCOTT E.C., 2004, "Why do Americans work so much more than Europeans?", *Federal Reserve Bank of Minneapolis Quarterly Review*, 28, no. 1, p. 2-13.

RAGAN K., 2004, "Fiscal policy and the family: explaining labor supply in a model with household production", mimeo, Department of Economics, University of Chicago.

REYNERI E., 1994, "Italy: A long wait in the shelter of the family and of safeguards from the State" in: O. Benoit-Guilbot and D. Gaillie (eds.), *Long-term Unemployment*, London: Pinter, p. 97-110

ROEGER W. and DE FIORE F., 1999, "Growth and employment effects of fiscal regimes", *Oxford Economic Papers*, 51, p. 200-222

ROGERSON R., 2003, "Taxation and market work: Is Scandinavia an outlier?", mimeo, Arizona State University.

SAPIR A., AGHION Ph., BERTOLA G., HELLWIG M., PISANI-FERRY J., ROSATI D., VIÑALS J. and WALLACE H., 2004, "Economic performance : Growth, stability and cohesion", An Agenda for a Growing Europe, Oxford : Oxford University Press, 27-83

TURNOVSKY S.J., 2000, "Fiscal policy, elastic labor supply, and endogenous growth", *Journal of Monetary Economics*, 45, p. 185-210

VAN DER PLOEG F., 2003, "Do social policies harm employment and growth?", *CESIFO Working Paper*, no. 886

WYPLOSZ C., 2001, "Economic growth and the labour markets: Europe's challenge", in: Smets J. and Dombrecht M. (eds.*), How to promote Economic Growth in the Euro Area*", Cheltenham : Edward Elgar, 152-176

YOUNG D., 2003, "Employment protection legislation: its economic impact and the case for reform", *Economic Papers*, European Commission, Brussels, no. 186

Appendix 1.

The effects of a change in fiscal policy on equilibrium growth and employment are obtained by totally differentiating Equations (15) and (16)

$$d\gamma = \left[\frac{-(1-\tau_k)\beta}{\gamma} \left(\frac{ql\sigma_y}{\gamma} \right)^{\beta/(1-\beta)} \right] d\gamma + \left[-(1-\beta) \left(\frac{ql\sigma_y}{\gamma} \right)^{\beta/(1-\beta)} \right] d\tau_k$$
$$+ \left[\frac{\beta(1-\tau_k)}{\sigma_y} \left(\frac{ql\sigma_y}{\gamma} \right)^{\beta/(1-\beta)} \right] d\sigma_y + \left[\frac{\beta(1-\tau_k)}{l} \left(\frac{ql\sigma_y}{\gamma} \right)^{\beta/(1-\beta)} \right] dl \qquad \text{(A.1)}$$

$$d\gamma = \left[\left(ql\sigma_y \right)^{\beta} \Omega^{1-\beta} \left(\frac{\beta}{\sigma_y} - \frac{(1-\beta)}{\Omega} \right) \right] d\sigma_y + \left[-(1-\beta)\Omega^{-\beta} \left(ql\sigma_y \right)^{\beta} \right] d\sigma_c$$
$$+ \left[(1-\beta)\Omega^{-\beta} \left(ql\sigma_y \right)^{\beta} \frac{\beta}{a} \frac{(1-\tau_l)}{(1+\tau_c)^2} (1-l) \left(\frac{1}{l} - v \right) \right] d\tau_c$$
$$+ \left[(1-\beta)\Omega^{-\beta} \left(ql\sigma_y \right)^{\beta} \frac{\beta}{a} \frac{1}{(1+\tau_c)} (1-l) \left(\frac{1}{l} - v \right) \right] d\tau_l \qquad \text{(A.2)}$$
$$+ \left[(1-\beta)\Omega^{-\beta} \left(ql\sigma_y \right)^{\beta} \frac{\beta}{a} \frac{1}{(1+\tau_c)} (1-l) \right] dv$$
$$+ \left[\left(ql\sigma_y \right)^{\beta} \beta\Omega^{1-\beta} \left(\frac{1}{l} + \frac{(1-\beta)}{a\Omega} \frac{(1-\tau_l)}{(1+\tau_c)} \left(\frac{1-vl}{l^2} \right) \right) \right] dl$$

with $\Omega = \left[\left(1 - \sigma_y - \sigma_c \right) - \frac{\beta}{a} \frac{(1-\tau_l)}{(1+\tau_c)} (1-l) \left(\frac{1}{l} - v \right) \right].$

It is not analytically possible to solve these equations in $d\gamma$ and dl and to compute the precise size of the effects of a change in fiscal policy on employment and growth as described in Figure 2. However, we can easily prove the sign of these effects.

In general, a change in any of the fiscal parameters x financed by changes in lump sum transfers will have a positive effect on employment if and only if for given employment the (upward) shift in the CC locus is larger than the shift in the PP locus. Likewise, this change will have a positive effect on growth if and only if for given growth the (rightward) shift in the CC locus is smaller than the shift in the PP locus. Algebraically,

$$\frac{dl}{dx} \geq 0 \quad \text{if and only if} \quad \left.\frac{d\gamma}{dx}\right|_{\bar{l},CC} \geq \left.\frac{d\gamma}{dx}\right|_{\bar{l},PP} \qquad \text{(and vice versa)}$$

$$\frac{d\gamma}{dx} \geq 0 \quad \text{if and only if} \quad \left.\frac{dl}{dx}\right|_{\bar{\gamma},CC} \leq \left.\frac{dl}{dx}\right|_{\bar{\gamma},PP} \qquad \text{(and vice versa)}$$

An increase in the tax rate on capital income will have a negative effect on employment and growth. Using (A.1) and (A.2) it can be shown that,

$$\left.\frac{d\gamma}{d\tau_k}\right|_{\bar{l},PP} = 0, \qquad \left.\frac{d\gamma}{d\tau_k}\right|_{\bar{l},CC} < 0 \quad \Rightarrow \quad \frac{dl}{d\tau_k} < 0$$

$$\left.\frac{dl}{d\tau_k}\right|_{\bar{\gamma},PP} = 0, \qquad \left.\frac{dl}{d\tau_k}\right|_{\bar{\gamma},CC} > 0 \quad \Rightarrow \quad \frac{d\gamma}{d\tau_k} < 0$$

An increase in the consumption tax rate or the labor income tax rate has a negative effect on employment and growth under the assumption that $\gamma > 0$ or likewise $\Omega > 0$.

$$\left.\frac{d\gamma}{d\tau_i}\right|_{\bar{l},CC} = 0, \qquad 0 < \left.\frac{d\gamma}{d\tau_i}\right|_{\bar{l},PP} \quad \Rightarrow \quad \frac{dl}{d\tau_i} < 0 \qquad i = c, l$$

$$\left.\frac{dl}{d\tau_i}\right|_{\bar{\gamma},CC} = 0, \qquad 0 > \left.\frac{dl}{d\tau_i}\right|_{\bar{\gamma},PP} \quad \Rightarrow \quad \frac{d\gamma}{d\tau_i} < 0 \qquad i = c, l$$

The effects of a rise in the transfer replacement rate v or a fall in government consumption expenditures σ_c are qualitatively the same as those of a rise in consumption or labor income tax rates.

Finally, an increase in productive government expenditures has a positive effect on growth but a theoretically ambiguous effect on employment. As we have already mentioned, ambiguity results from an unclear shift of the PP locus. Although it is analytically not possible to derive an unambiguous conclusion, if we rely on our simulation results in Section 3 we can show convincingly that under realistic parameter values productive government expenditures have a positive effect also on employment.

$$\left.\frac{\partial\gamma}{\partial\sigma_y}\right|_{\bar{l},CC} > \left.\frac{\partial\gamma}{\partial\sigma_y}\right|_{\bar{l},PP} \quad \Rightarrow \quad \frac{\partial l}{\partial\sigma_y} > 0$$

$$\left.\frac{\partial l}{\partial\sigma_y}\right|_{\bar{\gamma},CC} < \left.\frac{\partial l}{\partial\sigma_y}\right|_{\bar{\gamma},PP} \quad \Rightarrow \quad \frac{\partial\gamma}{\partial\sigma_y} > 0$$

Appendix 2. Fiscal shocks (equal to 3% of output) starting from US fiscal parameters as benchmark

Compensated by a change in lump sum transfers [a]						
	$\Delta\tau_l$ = -5.4	***$\Delta\tau_k$ = -7.5***	***$\Delta\tau_c$ = -4.5***	***$\Delta\sigma_y$ = +3***	***$\Delta\sigma_c$ = +3***	***Δv = -17.3***
Effect on employment Effect on growth Ex-post effect on lump sum transfers	Δl = +1.8 $\Delta\gamma$ = +0.04 $\Delta(z/y)$ = -3.3	Δl = +0.7 $\Delta\gamma$ = +0.14 $\Delta(z/y)$ = -3.1	Δl = +1.0 $\Delta\gamma$ = +0.02 $\Delta(z/y)$ = -3.0	Δl = +1.4 $\Delta\gamma$ = +0.52 $\Delta(z/y)$ = -3.2	Δl = +1.0 $\Delta\gamma$ = +0.02 $\Delta(z/y)$ = -3.2	Δl = +2.7 $\Delta\gamma$ = +0.06 $\Delta(z/y)$ = +2.4
Compensated by a change in another fiscal policy variable, indicated vertically						
Changing : **Compensating [b] :**	***$\Delta\tau_l$ = -5.4***	***$\Delta\tau_k$ = -7.5***	***$\Delta\tau_c$ = -4.5***	***$\Delta\sigma_y$ = +3***	***$\Delta\sigma_c$ = +3***	***Δv = -17.3***
$\Delta\tau_l$	-	$\Delta\tau_l$ = 5.1 Δl = -1.2 $\Delta\gamma$ = +0.09	$\Delta\tau_l$ = 4.9 Δl = -0.8 $\Delta\gamma$ = -0.02	$\Delta\tau_l$ = 5.3 Δl = -0.5 $\Delta\gamma$ = +0.50	$\Delta\tau_l$ = 5.2 Δl = -0.9 $\Delta\gamma$ = -0.03	$\Delta\tau_l$ = -3.92 Δl = +4.0 $\Delta\gamma$ = +0.10
$\Delta\tau_k$	$\Delta\tau_k$ = 8.0 Δl = +1.1 $\Delta\gamma$ = -0.13	-	$\Delta\tau_k$ = 7.5 Δl = +0.3 $\Delta\gamma$ = -0.14	$\Delta\tau_k$ = 7.8 Δl = +0.7 $\Delta\gamma$ = +0.33	$\Delta\tau_k$ = 7.6 Δl = +0.3 $\Delta\gamma$ = -0.14	$\Delta\tau_k$ = -5.6 Δl = +3.2 $\Delta\gamma$ = +0.18
$\Delta\tau_c$	$\Delta\tau_c$ = 5.0 Δl = +0.8 $\Delta\gamma$ = + 0.01	$\Delta\tau_c$ = 4.8 Δl = -0.3 $\Delta\gamma$ = +0.12	-	$\Delta\tau_c$ = 5.2 Δl = +0.4 $\Delta\gamma$ = +0.49	$\Delta\tau_c$ = 5.0 Δl = 0.0 $\Delta\gamma$ = 0.0	$\Delta\tau_c$ = -3.5 Δl = +3.4 $\Delta\gamma$ = +0.08
$\Delta\sigma_y$	$\Delta\sigma_y$ = -3.0 Δl = +0.3 $\Delta\gamma$ = -0.55	$\Delta\sigma_y$ = -2.9 Δl = -0.9 $\Delta\gamma$ = -0.43	$\Delta\sigma_y$ = -2.9 Δl = -0.5 $\Delta\gamma$ = -0.55	-	$\Delta\sigma_y$ = -2.9 Δl = -0.5 $\Delta\gamma$ = -0.54	$\Delta\sigma_y$ = +2.1 Δl = +3.7 $\Delta\gamma$ = +0.45
$\Delta\sigma_c$	$\Delta\sigma_c$ = -3.1 Δl = +0.8 $\Delta\gamma$ = + 0.01	$\Delta\sigma_c$ = -2.9 Δl = -0.3 $\Delta\gamma$ = +0.12	$\Delta\sigma_c$ = 0.0 Δl = 0.0 $\Delta\gamma$ = 0.0	$\Delta\sigma_c$ = -3.1 Δl = +0.4 $\Delta\gamma$ = +0.49	-	$\Delta\sigma_c$ = + 2.1 Δl = +3.4 $\Delta\gamma$ = +0.08
Δv	Δv = -24.4 Δl = +5.5 $\Delta\gamma$ = 0.13	Δv = -24.0 Δl = +4.4 $\Delta\gamma$ = +0.24	Δv = -23.5 Δl = +4.6 $\Delta\gamma$ = 0.11	Δv = -25.7 Δl = +5.3 $\Delta\gamma$ = +0.64	Δv = -24.8 Δl = +4.8 $\Delta\gamma$ = +0.12	-

[a] All changes in fiscal policy variables and changes in employment (in hours) and growth are changes in percentage points compared to the benchmark obtained from average US fiscal policy parameters in 1995-2001, i.e. τ_l = 34.7, τ_k = 39.3, τ_c = 7.2, σ_y = 9.6, σ_c = 9.8, v = 15.3 (see Table 3).

[b] The upper line in each rectangle indicates the precise size of the compensation.

Appendix 3. Fiscal policy data and data sources

<u>Tax rate on labor income</u>

Our proxy for the tax rate on labor income concerns the total tax wedge, for which we report the marginal rate in percent. The data cover personal income taxes, employee and employer social security contributions payable on wage earnings and payroll taxes. We have calculated the average of these marginal rates for three family situations. These family types are a single individual without children who earns 100% of the average production worker's gross wage (APW), a married couple with two children where the main earner receives 100% of the APW and the secondary earner 33% of the APW, and a married couple with two children where the main earner recieves 100% of the APW and the secondary earner 67% of the APW.

<u>Tax rate on capital income</u>

As a proxy for the tax rate on capital income we use corporate statutory tax rates (inclusive of local taxes) collected by the Institute for Fiscal Studies (see also Devereux et al., 2002).

<u>Tax rate on consumption</u>

We have calculated our proxy for the tax rate on consumption according to the formula below, starting from OECD data. An important underlying assumption is that consumption tax rates correspond to aggregate indirect tax rates:

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

with *TIND* nominal indirect taxes received by the government, *SUBS* nominal subsidies paid by the government and *TDD* total nominal domestic demand.

<u>(Non-productive) government consumption</u>

This category is calculated as total government consumption in percent of GDP, diminished with the fraction of public education outlays going to wages and working-expenses. In our model all public spending on education is productive. In national accounts data, however, most of the education expenditures (wages, working-expenses) are included in government consumption. Rough calculation for a few countries suggests that wages and working-expenses constitute about 85% of total education spending. We therefore deduct this amount from reported data on government consumption to obtain the data for σ_c in Table 3.

<u>Productive government expenditures</u>

The data in Table 3 are a sum of four categories: public expenditures on education, public expenditures on active labor market policy, government-financed R&D expenditures and government fixed investment. Table 3A shows underlying details.

TABLE 3A Productive government expenditures (1995-2001, % of GDP)

	Public education expenditure $^{\alpha}$	Public expenditures active labor market policy $^{\beta}$	Government-financed R&D $^{\gamma}$	Government fixed investment $^{\gamma}$
Austria	5.92	0.45	0.72	1.98
Belgium	4.73	1.34	0.44	1.76
France	5.83	1.29	0.86	3.10
Germany	4.67	1.33	0.80	1.95
Netherlands	4.97	1.53	0.75	3.05
Italy	4.78	0.81	0.52	2.73
Average	**5.15**	**1.12**	**0.68**	**2.43**
Finland	6.65	1.33	0.86	2.85
Denmark	8.27	1.67	0.69	1.80
Norway	7.35	0.96	0.70	3.15
Sweden	7.77	1.83	0.92	2.98
Average	**7.51**	**1.45**	**0.79**	**2.70**
Spain	4.67	0.70	0.35	3.41
Portugal	5.75	0.75	0.39	4.03
Ireland	5.33	1.38	0.46	3.01
Average	**5.25**	**0.94**	**0.37**	**3.48**
US	**5.57**	**0.17**	**0.79**	**3.10**
Switzerland	**5.15**	**0.31**	**0.66**	**2.66**
UK	**4.88**	**0.37**	**0.57**	**1.53**

Notes: Since not all data are available for each country in the whole period 1995-2001, we report averages of all available annual data.
Sources: $^{\alpha}$ OECD (2003 & 2004a), Education at a glance, UNESCO (www.uis.unesco.org); $^{\beta}$ OECD (2005), Economic Outlook, OECD (2001 & 2002), Employment Outlook; $^{\gamma}$ OECD (2005), Economic Outlook

Net transfer replacement rate related to structural non-employment

The data concern net transfers received by long-term unemployed people and include social assistance, family benefits and housing benefits in the 60th month of benefit receipt. They also include unemployment insurance or unemployment assistance benefits if these benefits are still paid, i.e. if workers can be structurally unemployed for more than five years without losing benefit eligibility. This is the case in Austria, Belgium, France, Germany, Finland, Ireland, and the UK. Workers cannot be structurally non-employed and still receive unemployment benefits in the Netherlands, Italy, Denmark, Norway, Sweden, Spain, Portugal, Switzerland and the US (OECD, www.oecd.org/els/social/workincentives, Benefits and Wages, country specific files). The data are expressed in percent of after tax wages. They are an average for four family types and two earnings levels.

Appendix 4. Derivation of equilibrium welfare

Equations (4) and (5') imply that

$$U = \int_0^{\infty} \left[\ln(c_t) + a\ln(1-l_t) + a\ln(\sigma_c y_t) \right] e^{-\rho t} dt$$

Equations (18) and (19) describe how private consumption and output will evolve over time.

$$c_t = c_0\, e^{\gamma t} \tag{18}$$

$$y_t = y_0 e^{\gamma t} \tag{19}$$

Substituting these equations into the individual's intertemporal utility function, and recognizing that optimal *l* will not vary over time, we can determine equilibrium welfare as

$$U = \int_0^{\infty} \ln(c_0) e^{-\rho t} dt + \int_0^{\infty} a\ln(1-l) e^{-\rho t} dt + \int_0^{\infty} a\ln(\sigma_c y_0) e^{-\rho t} dt + \int_0^{\infty} (1+a)\gamma\, t\, e^{-\rho t} dt \tag{20}$$

Integrating by parts, we have

$$\begin{aligned} U = & \left[\ln(c_0) \frac{-1}{\rho} e^{-\rho t} \right]_0^{\infty} + \left[a\ln(1-l) \frac{-1}{\rho} e^{-\rho t} \right]_0^{\infty} + \left[a\left(\ln(\sigma_c) + \ln(y_0) \right) \frac{-1}{\rho} e^{-\rho t} \right]_0^{\infty} \\ & + \left[(1+a)\gamma \left(\frac{-1}{\rho} e^{-\rho t} (t + \frac{1}{\rho}) \right) \right]_0^{\infty} \end{aligned} \tag{21}$$

Using l'Hôpital's rule, the welfare level is equal to

$$U = \frac{\ln(c_0)}{\rho} + \frac{(1+a)\gamma}{\rho^2} + \frac{a\ln(1-l)}{\rho} + \frac{a\left(\ln(\sigma_c) + \ln(y_0) \right)}{\rho} \tag{22}$$

Finally, to compute the equilibrium welfare level, we still need to determine the initial value of consumption, c_0 and the initial value of output, y_0. To determine c_0, we re-arrange the intratemporal optimality condition (12) as an equation for *(c/k)*.

$$\frac{c}{k} = \frac{1}{a} \frac{(1-l)}{(1+\tau_c)} \left[(1-\tau_l)\beta \left(\frac{hl}{k} \right)^{\beta} l^{-1} - \frac{b}{k} \right] \tag{23}$$

Then, substituting Equations (9) and (13) into (23) gives us the equilibrium *(c/k)* value. Assuming in all countries an initial value of capital k_0 equal to 1, we obtain c_0. To determine $y_0 = k_0^{1-\beta} (h_0^{\beta} l^{\beta})$, we additionally assume h_0 equal to 1.