Hours worked: Explaining the cross-country differences through the effects of tax/benefit systems on the employment rate

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Abstract

In this paper, we explain the observed lower hours worked in Central and Nordic European countries since the 80s, relative to Anglo-Saxon countries, through the effects of the tax benefit/systems on the employment rate. To this end we develop a search and matching economy *à la* Pissarides that then we use as laboratory to conduct several quantitative experiences using an accounting method.

JEL: E2, J2, J6.

Keywords: Aggregate hours of work, employment rate, labor taxes, consumption tax, labor market institutions, matching model.

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Introduction

Roughly since the 70s, most European countries have showed worse labor market performances than the United States. In particular, the aggregate work effort in Europe has been lower, whereas the tax/benefits systems have been more generous and have implied more rigid institutions than in the United States. The interesting issue of understanding in which way the lower work effort in Europe has been shaped by the Tax/Benefit systems have generated a large number of papers. Our contribution to this rich literature consists in conducting a quantitative exercise allowing to assess the role of several tax/benefit-related variables in explaining the differences in total hours worked across a large sample countries. To this end, we follow the procedure advocated in Ohanian, Raffo, and Rogerson (2006) and further developed in Langot and Quintero-Rojas (2008b).

In brad terms, we proceed as follows. First, we analyze some data regarding several features of the labor market of 10 OECD countries over the 1980-2003 period. To easier the discussion, countries are grouped according to a broad socioeconomic criteria into Central, Nordic and Anglo-Saxon countries. Central European countries include Belgium, Spain, France, Italy and Austria. Nordic European countries include Netherlands, Finland and Sweden, and Anglo-Saxon countries include the United Kingdom and the United Sates. Next, we develop a theoretical economy that then we use as laboratory to asses the relative weight of several tax/benefit-related variables in explaining the evolution of total hours worked. In view of the fact that since the 80s the employment has largely driven the dynamics of the hours worked[1], we develop a search economy *à la* Pissarides with bargaining only on wages. That is, we assume that all the adjustments are done along the extensive margin, whereas the number of hours worked per employee is fixed. Finally, in broad terms, the quantitative evaluation of the model is worth to measure the size of the "error" that is produced by introducing actual data on the labor-market-equilibrium conditions. So, the closer the error is to zero, the better the model explains the data.

[1]See Langot and Quintero-Rojas (2008b) for a deeper discussion on this point, or Bassanini and Duval (2006) who provide a review of recent literature on this topic, or even Blanchard and Wolfers (2000) or Ljungqvist and Sargent (2007a), (2007b) and (2008b) for former evidence on this lines.

1 Some Facts

This part is consecrated to a trifling analysis of some data over the 1980-2003 period[2]. On the one side, we look at the aggregate hours worked and employment. On the other side, we focus on various labor market indicators typical of the tax/benefit systems. These are: the average tax rates on labor income (τ_w), on consumption (τ_c) and payroll taxes (τ_f). The average replacement rate on the first year (arr), and the bargaining power of workers ($1-\epsilon$). Even if from this analysis we cannot deduce evident relations between work effort and institutions, given the magnitude of the last ones, and their likely impact on employment, we try later to asses the role of institutions on shaping the employment dynamics, and then the aggregate hours dynamics.

1.1 Aggregate hours worked and employment

Aggregate hours of market work (H) are simply defined as the product of the average annual hours worked per person in employment (h) and the employment (N). To be able to do comparisons across countries of quite different sizes, we normalize this measure by the active population (A). We observe some relevant aspects of aggregate hours worked from 1980 to 2003 (see top panels of figures 1-3). In particular, at the beginning of the period, in all Central European countries the aggregate hours show a weak decline. However, soon after, they show virtually no trend, an they are even increasing at the end. The only exception is France, where hours were slightly declining over the whole period. Similar path, but less marked, is founded in most Nordic countries as well as in the United Kingdom. Conversely, in the United States aggregate hours are declining at the end, whereas in Finland we observed a sharp adjustment period, from 1989 to 1993, towards much lower (but increasing) levels. Nonetheless, the striking regularity across all countries (maybe less marked in Austria) is that the employment rates exhibit pretty similar trend changes as aggregate hours (see bottom panels of figures 1-3).

[2]See the section Parameterization for data sources and further description.

Figure 1: Total hours dynamics & Employment dynamics - Central European countries

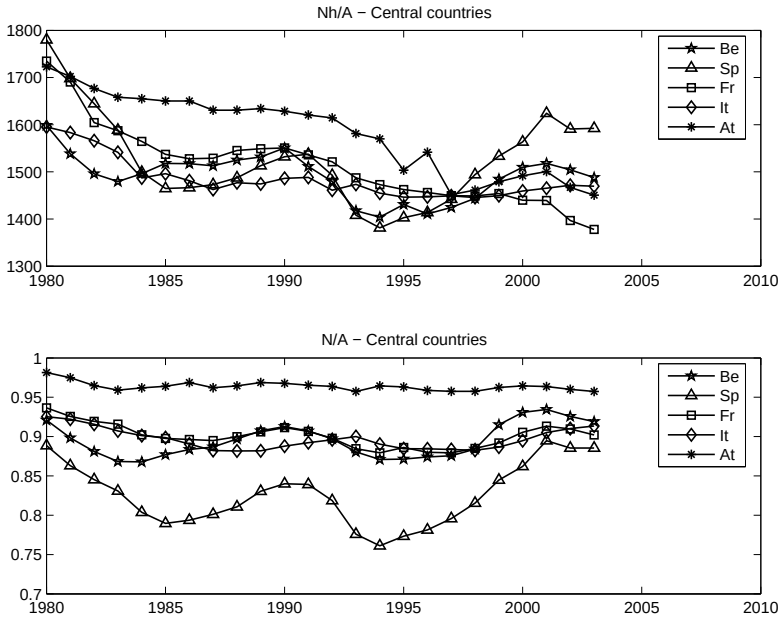


Figure 2: Total hours dynamics & Employment dynamics - Nordic European countries

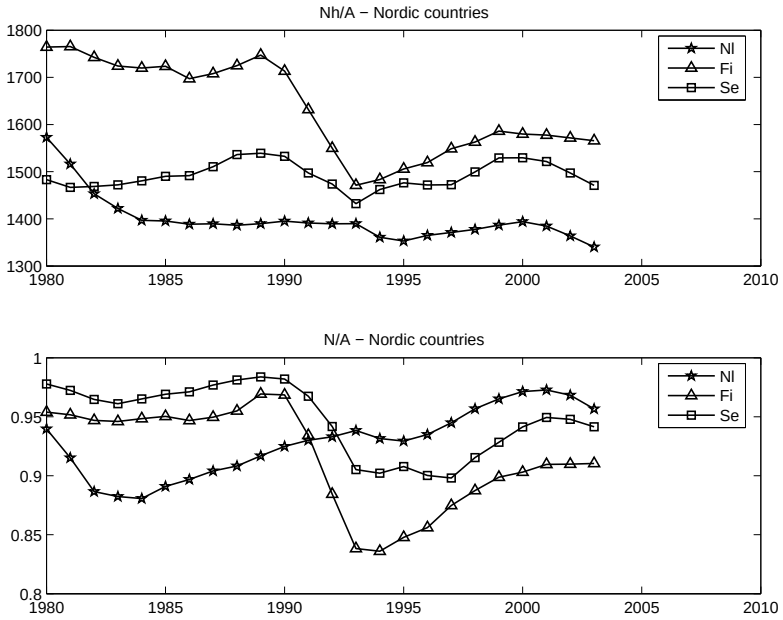
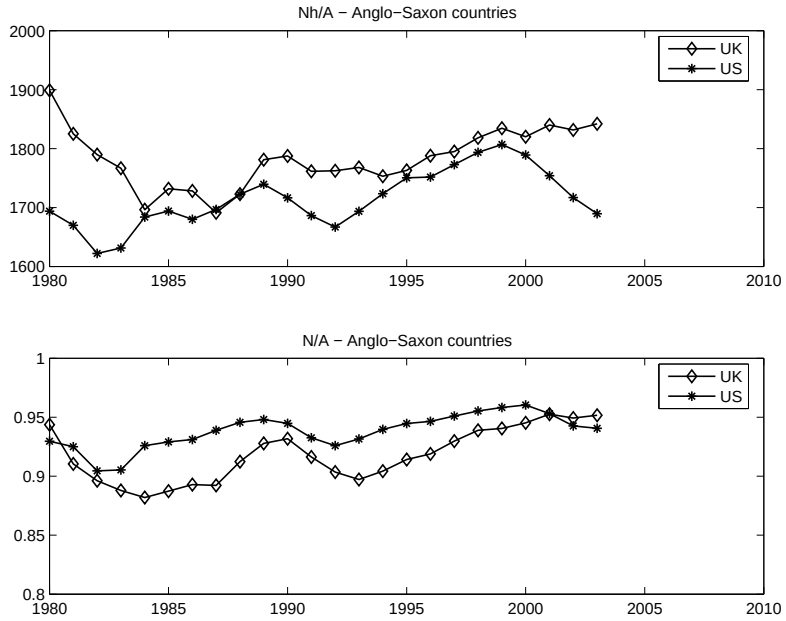


Figure 3: Total hours dynamics & Employment dynamics - Anglo-Saxon countries



1.2 Fiscal variables

For the fiscal variables, we use the series of the average tax rates on consumption and labor income constructed by McDaniel (2007), whereas the payroll tax rates are deduced from the OECD data on wages and salaries and compensation of employees. Figures 4 and 5 show the dynamics in each country of the several taxes that define our tax wedge (τ)[3]: the payroll tax (τ_f), the tax on labor income (τ_w) and the tax on consumption (τ_c). These figures show that in all Nordic and Central European countries, except Spain, the tax wedge as well as the taxes on labor are higher than in the Anglo-Saxon countries. Contrary, the consumption tax is more or less homogeneous and soaring in all countries apart from Italy, Spain and the United States where it is much lower.

1.3 Bargaining power

As long as we known, there are no time series estimations of the worker's bargaining power in each country. Nevertheless, we have two statistical indicators that give a

[3]The tax wedge is defined as $\tau_t \equiv \frac{(1+\tau_{f,t})(1+\tau_{c,t})}{1-\tau_{w,t}}$, so that by construction it could be grater than one, and it has not evident economic meaning.

Figure 4: Labor income tax (τ_w) & Payroll tax (τ_f)

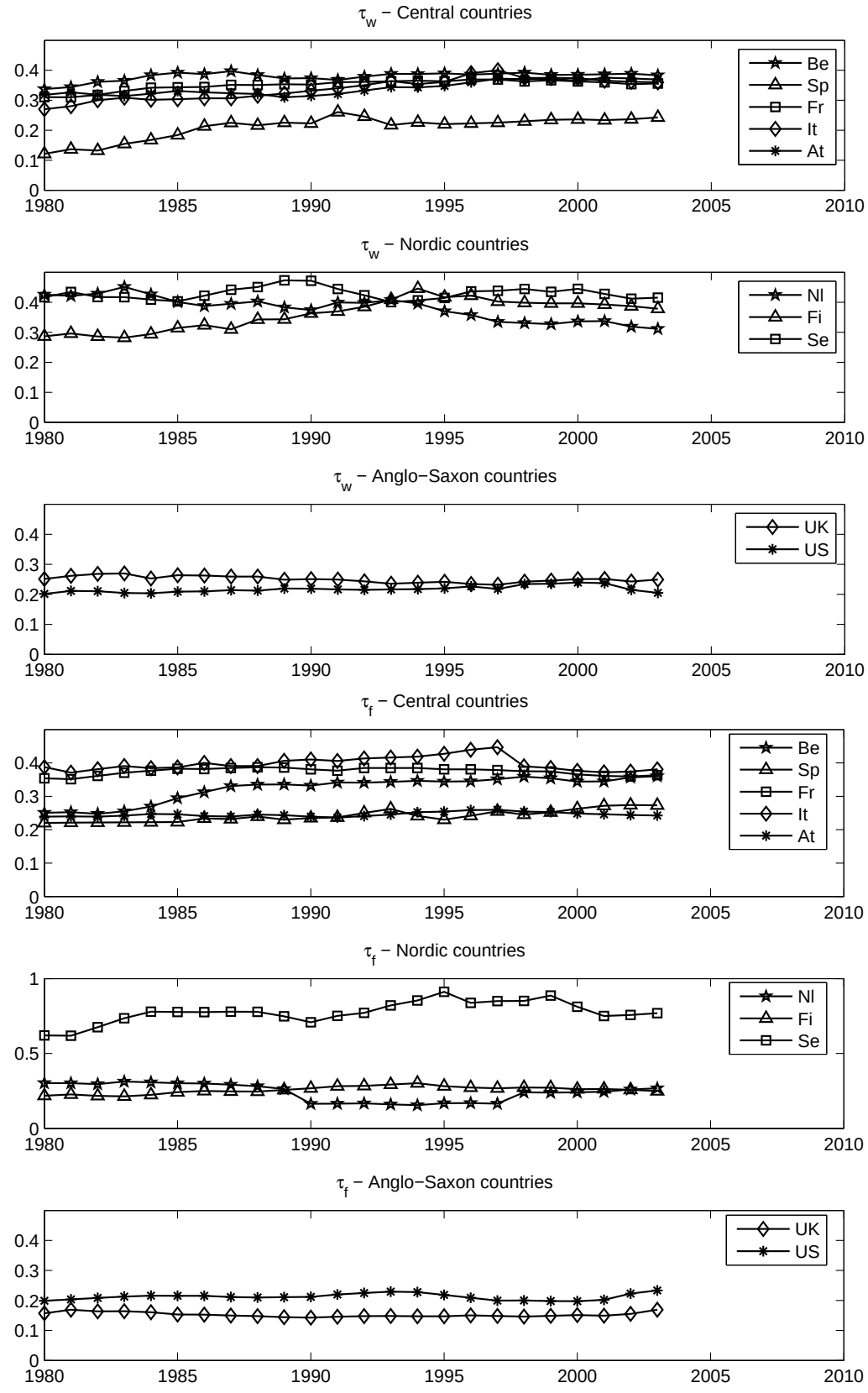
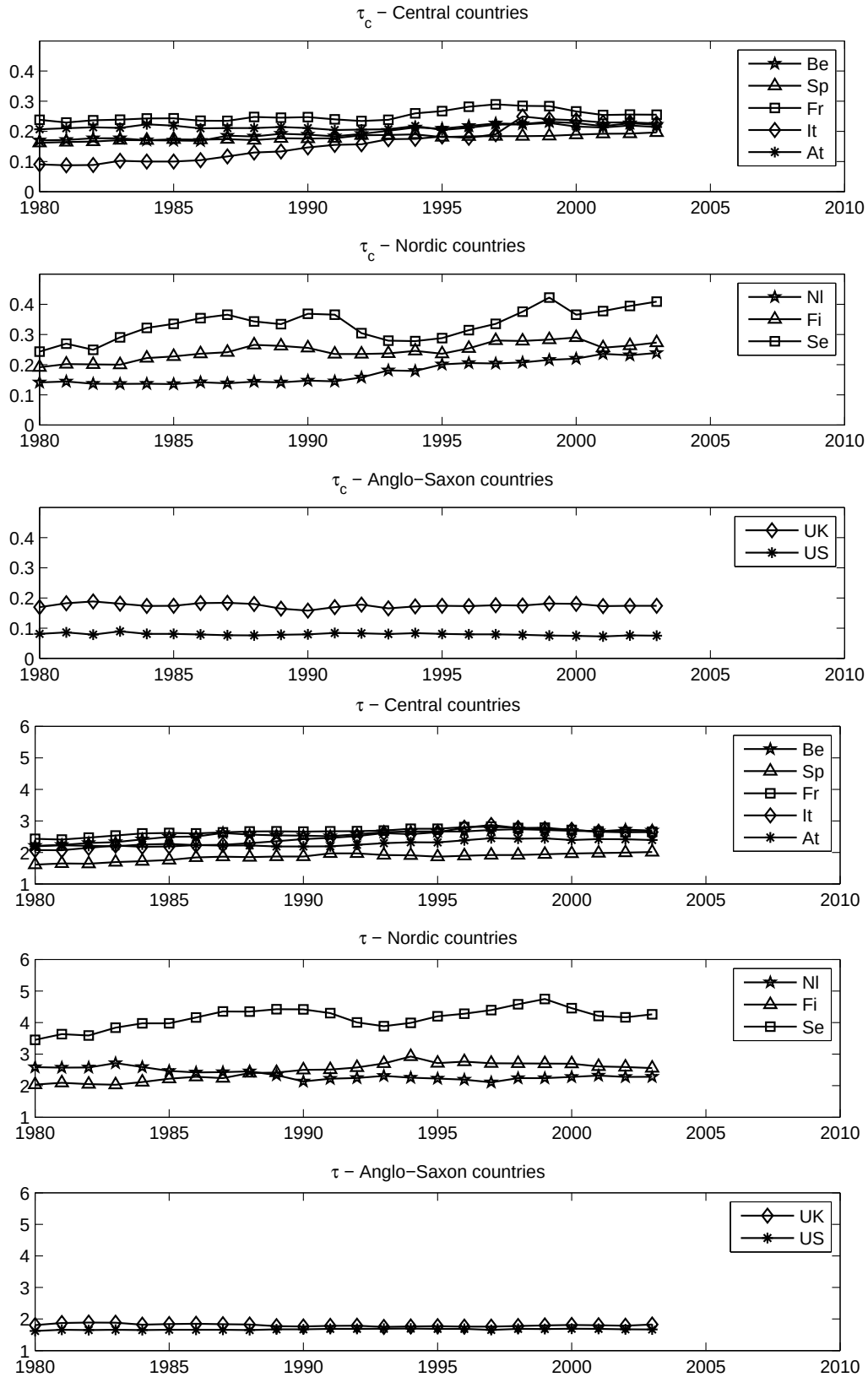


Figure 5: Consumption tax (τ_c) & Tax wedge (τ)



good idea of the power of employees during the wage bargaining process: the union coverage and the union density. Indeed, a large union coverage or a high union density imply a low probability for the employee of being alone during the bargain. Then, the worker's bargaining power, $1 - \epsilon_{i,t}$, is settled equal to the average of the union coverage and the union density, using the Bassanini and Duval (2006)' data.

According to the left-hand side panel of figure 6, we have the following classification. Countries where workers have higher bargaining power than firms: Belgium, Italy, Austria, Finland and Sweden; countries where workers and firms have similar bargaining power: France, Netherlands and the United Kingdom; and countries where workers have lower bargaining power than firms: Spain and the United States.

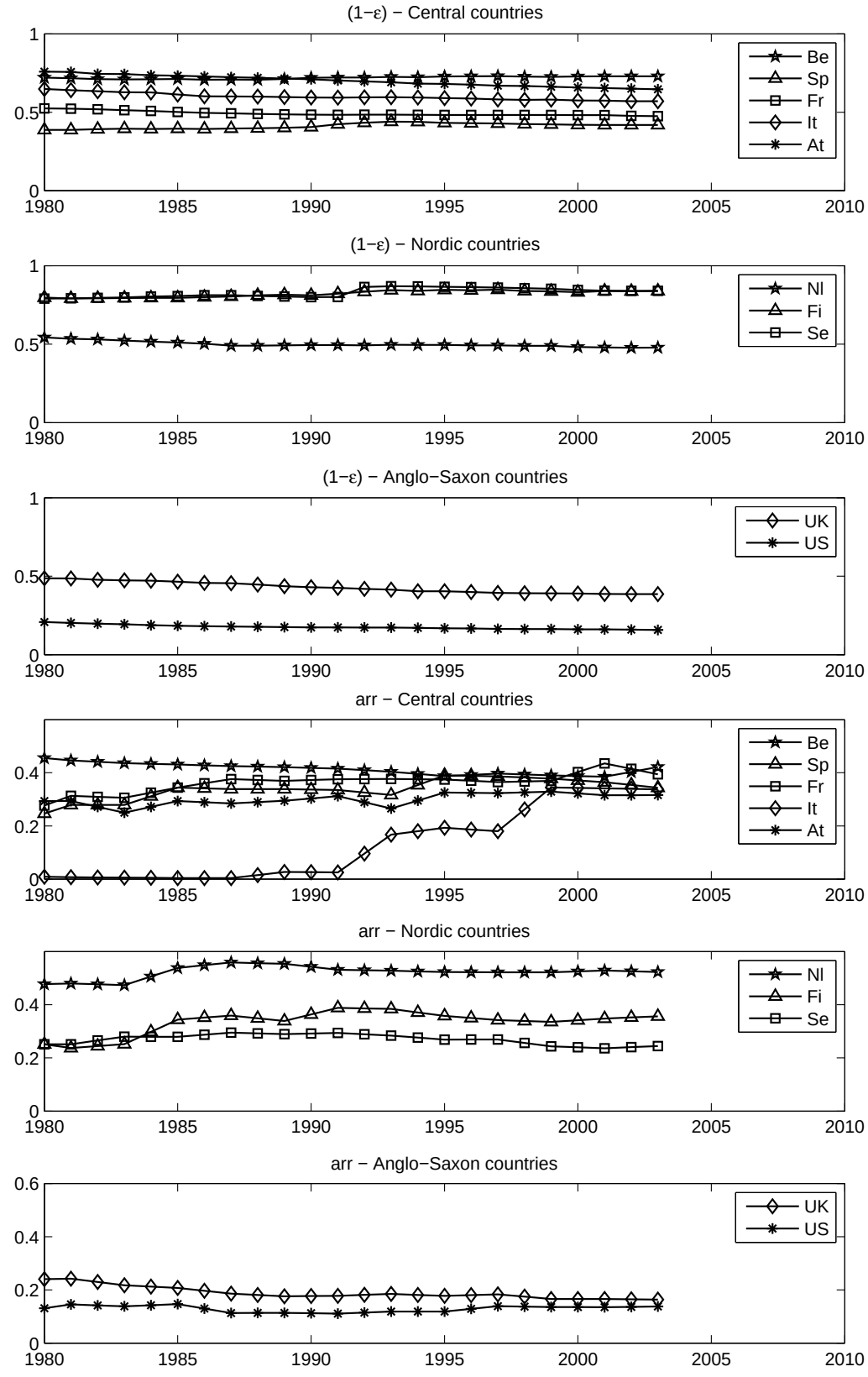
1.4 Unemployment benefits

Other key component of the tax/benefit systems are the unemployment benefits, which are mainly driven by the average rate of replacement during the first year (Bassanini and Duval 2006) and the wage rate net of taxes. From the right-hand side panel of figure 6, we observe that over the whole period most countries show average replacement rates on the first year of unemployment (arr) ranking between 20% and 40%. The few exceptions are the United States, where the replacement rate is below 20%, the Netherlands, where it exceeds the 40%, and Spain, where this rate is equal to zero until around 1992.

2 The search economy

In this section we present the theoretical economy that will be use as "laboratory" for our accounting experiences. Since we are interested on assessing the relative weight of fiscal policy and some labor market institutions on the extensive margin of the aggregate working time, the natural candidate is the neo-classical growth model where the labor market equilibrium is determined by a search process and a wage bargaining process. By construction, the model already features several institutions: costs of search and matching, unemployment benefits and the bargaining power of workers. So we just extend it to include the following fiscal variables: taxes on labor income, on consumption and payroll taxes.

Figure 6: Bargaining power of workers $(1-\epsilon)$ & Average replacement rate (arr)



2.1 Labor market flows

Employment is predetermined at each time and changes only gradually as workers separate from jobs, at the exogenous rate s, or unemployed agents find jobs, at the hiring rate M_t. Let N_t and V_t, respectively be the number of workers and the total number of new jobs made available by firms, then employment evolves according to

$$N_{t+1} = (1-s)N_t + M_t$$

with $M_t = V_t^{\psi}(1-N_t)^{1-\psi}, \quad 0 < \psi < 1.$

2.2 Households

The economy is populated by a large number of identical households whose measure is normalized to one. Each household consists of a continuum of infinitely-lived agents. The household's members faces an employment lottery at each period, so that a fraction N_t will be employed while the remaining $1-N_t$ will be seeking a job. Employed agents work a fixed amount of time h at the wage rate of w_t. Unemployed agents receives the unemployment benefits b_t, until they are randomly matched with job vacancies. But in both states, their incomes are taxed at rate $\tau_{w,t}$.

As is usual in this literature, individual idiosyncratic risks faced by each agent in her job match are perfectly insured, then the representative household's preferences are:

$$\sum_{t=0}^{\infty} \beta^t [N_t U(C_t^n, 1-h) + (1-N_t)U(C_t^u)] \tag{1}$$

where $0 < \beta < 1$ is the discount factor. C_t^n and C_t^u stand for the consumption of employed and unemployed agents. Consumption goods are taxed at rate $\tau_{c,t}$. The contemporaneous utility function is assumed to be increasing and concave in both arguments and it shows conventional separability between consumption and leisure:

$$U(C_t^z, L_t^z) = \ln C_t^z + \Gamma^z, \quad z = n, u.$$

where $\Gamma^n = \Gamma^n(h) = \sigma \ln(1-h)$ and $\Gamma^u = \Gamma^u(0) = 0$.

Households owns firms and capital K_t, which is rented to firms at net price $(r_t + \delta)$, where $0 < \delta < 1$ is the depreciation rate of capital. We assume a balanced

budget at each period. Then, the budget constraint of the representative household is:

$$(1+\tau_{c,t})\left[N_t C_t^n + (1-N_t)C_t^u\right] + K_{t+1} - (1+r_t)K_t = \tag{2}$$
$$(1-\tau_{w,t})[N_t w_t h_t + (1-N_t)b_t] + L_t + \pi_t$$

In last expression π_t are lump-sum dividends remitted by firms and L_t is a lump-sum transfer from the government.

A household's employment opportunities evolve as follows:

$$N_{t+1} = (1-s)N_t + \Psi_t(1-N_t) \tag{3}$$

$\Psi \equiv M_t/(1-N_t)$ is the rate at which unemployed agents find jobs.

Then, each household chooses $\{C_t^n, C_t^u, K_{t+1}|t \geq 0\}$ to maximize (1) subject to the labor supply constraint (3) and to the budget constraint (2). This program can be written in a recursive form and the solution satisfies the Bellman's equation,

$$\mathcal{W}^H(K_t) = \max_{C_t^n, C_t^u, K_{t+1}} \left\{N_t U(C_t^n, 1-h) + (1-N_t)U(C_t^u, 1) + \beta \mathcal{W}^H(K_{t+1})\right\} \tag{4}$$

Let λ_t be the shadow price of the budget constraint. Then, the optimality conditions are,

$$(C_t^u)^{-1} = (C_t^n)^{-1} \equiv (C_t)^{-1} = (1+\tau_{c,t})\lambda_t \tag{5}$$

$$\beta(1+r_{t+1})\lambda_{t+1} = \lambda_t \tag{6}$$

2.3 Firms

There are many identical firms in the economy. Each firm chooses a number V_t of job vacancies, produces consumption goods and pays wages, capital services and a payroll tax τ_f. The unit cost of maintaining an open vacancy is ω. Each firm has access to a Cobb-Douglas production technology to produce output:

$$Y_t = A_t K_t^{\alpha}(N_t h)^{1-\alpha}, \quad 0 < \alpha < 1 \tag{7}$$

Job vacancies are matched at the constant rate $\Phi_t = M_t/V_t$. Hence, a firm's labor employment evolves as

$$N_{t+1} = (1-s)N_t + \Phi_t V_t \tag{8}$$

Each firm chooses $\{N_{t+1}, K_t, V_t | t \geq 0\}$ to maximize the discounted sum of dividend flows,

$$\sum_{t=0}^{\infty} \frac{1}{1+r_t} \pi_t = \sum_{t=0}^{\infty} \frac{1}{1+r_t} \left(Y_t - (r_t + \delta)K_t - \omega_t V_t - (1+\tau_{f,t}) w_t N_t h\right) \tag{9}$$

subject to the constraint (7), and to the labor constraint (8). This program can be written in a recursive form and the solution satisfies the Bellman's equation,

$$\mathcal{W}^F(K_t, N_t) = \max_{V_t, N_{t+1}, K_{t+1}} \left\{ \pi_t + \frac{1}{1+r_{t+1}} \mathcal{W}^F(K_{t+1}, N_{t+1}) \right\} \tag{10}$$

The optimality conditions for the firm are,

$$r_t = \alpha \frac{Y_t}{K_t} - \delta \tag{11}$$

$$\frac{\omega}{\Phi_t} = \frac{1}{1+r_{t+1}} \left[(1-\alpha) \frac{Y_{t+1}}{N_{t+1}} - (1+\tau_{f,t}) w_{t+1} h + \frac{\omega}{\Phi_{t+1}} (1-s) \right] \tag{12}$$

2.4 Government

The government levies taxes to finance expenditures. We assume a balanced budget at each period, so that any revenue that is not used to finance current purchases is transferred to households in a lump-sum payment. Thus, real transfer stream to households is given by:

$$L_t = \tau_{c,t}[N_t C_t^n + (1-N_t) C_t^u] + (\tau_{f,t} + \tau_{w,t}) w_t h_t N_t - b_t (1-\tau_{w,t})(1-N_t) \tag{13}$$

2.5 Nash bargaining

Wages are determined *via* generalized Nash bargaining between individual workers and firms:

$$\max_{w_t} (\lambda_t \mathcal{V}_t^F)^{\epsilon_t} (\mathcal{V}_t^H)^{1-\epsilon_t} \tag{14}$$

with $\mathcal{V}_t^F = \frac{\partial \mathcal{W}^{\mathcal{F}}(K_t, N_t)}{\partial N_t}$ the marginal value of a match for a firm and $\mathcal{V}_t^H = \frac{\partial \mathcal{W}(K_t)}{\partial N_t}$ the marginal value for a match for a worker, and ϵ_t denotes the firm's bargaining power at date t. In coherence with our empirical measure of the worker's bargaining power this parameter varies over time and across countries.

The first order condition of this problem implies the following sharing rule of the bargained surplus:

$$\epsilon_t(1+\tau_{f,t})\mathcal{V}_t^H = (1-\epsilon_t)\lambda_t(1-\tau_{w,t})\mathcal{V}_t^F \tag{15}$$

which in turn implies the following wage contracts:[4]

$$(1+\tau_{f,t})w_t h = (1-\epsilon_t)\left[(1-\alpha)\frac{Y_t}{N_t} + S_t\right] + \epsilon_t\left[b_t + \tau_t(\Gamma^u - \Gamma^n)C_t\right] \tag{16}$$

where the tax wedge is defined as:

$$\tau_t \equiv \frac{(1+\tau_{f,t})(1+\tau_{c,t})}{1-\tau_{w,t}}$$

whereas the search costs S_t are given by:

$$S_t = \left\{\left(1 - \frac{1+\tau_{f,t}}{1+\tau_{f,t+1}}\frac{1-\tau_{w,t+1}}{1-\tau_{w,t}}\frac{\epsilon_t}{\epsilon_{t+1}}\frac{1-\epsilon_{t+1}}{1-\epsilon_t}\right)\frac{1-s}{\Phi_t} + \left(\frac{1+\tau_{f,t}}{1+\tau_{f,t+1}}\frac{1-\tau_{w,t+1}}{1-\tau_{w,t}}\frac{\epsilon_t}{\epsilon_{t+1}}\frac{1-\epsilon_{t+1}}{1-\epsilon_t}\right)\frac{\Psi_t}{\Phi_t}\right\}\omega$$

As we can see, the bargained wage is affected in a complex way by the fiscal variables: τ_c, τ_f *and* τ_w, the tax/benefit variables: ϵ_t, b_t *and* ω, and by the labor market tightness, defined as $\theta_t \equiv V_t/(1-N_t) = \Psi_t/\Phi_t$.

2.6 Equilibrium on the labor market

In this section we deduce the theoretical equation determining the equilibrium allocation of work. This will then evaluated in a quantitative manner in next section.

2.6.1 Supply side

The labor supply is determined by the wage contract (16). Once we index the unemployment benefits to the wage, $b_t = arr_t w_t h$ where arr_t denotes the average replacement rate, the wage equation can then be rewritten as:

$$(1+\tau_{f,t})w_t h = \frac{1-\epsilon_t}{1-\epsilon_t arr_t}\left[(1-\alpha)\frac{Y_t}{N_t} + S_t\right] + \frac{\epsilon_t}{1-\epsilon_t arr_t}\tau_t(\Gamma^u - \Gamma^n)C_t \tag{17}$$

This equation describes opportunity cost of working for a marginal employee as the sum of two components: the bargained surplus and the reservation wage. The reservation wage is only affected by the tax/benefit system (tax wedge and unemployment benefits), whereas the bargained surplus is affected by other labor market frictions through the search costs.

[4] See Chéron and Langot (2004) for more details on the wage bargaining process in the neo-classical growth model with matching.

2.6.2 Demand side

After the wage bargaining process, the right to manage assumption leads the firms to hire a number of workers given the labor cost per employee (17). Then, the labor demand of the firm is determined by the vacancies equation, which together with the household's optimality conditions (5) and (6) yields:

$$\frac{\omega}{\Phi_t} = \beta \frac{(1+\tau_{c,t})C_t}{(1+\tau_{c,t+1})C_{t+1}} \left[(1-\alpha)\frac{Y_{t+1}}{N_{t+1}} - (1+\tau_{f,t})w_{t+1}h + \frac{\omega}{\Phi_{t+1}}(1-s) \right]$$

or, equivalently, after reordering terms and delaying one period,

$$(1+\tau_{f,t})w_t h = (1-\alpha)\frac{Y_t}{N_t} + (1-s)\frac{\omega}{\Phi_t} - \left\{ \frac{(1+\tau_{c,t})C_t}{\beta(1+\tau_{c,t-1})C_{t-1}} \right\} \frac{\omega}{\Phi_{t-1}} \tag{18}$$

This equation describes the return from the marginal employee as the sum of the instantaneous and the intertemporal returns from labor.

2.7 Measuring the "goodness of fitness" of the model

In broad terms, the quantitative evaluation of the model and the impact of distortions is based on the computation of series for the gap (Δ) between the marginal cost of labor (MCL, equation (17)) and its marginal return (MRL, equation (18)) that is produced using actual data. That is,

$$MRL = (1-\Delta) \times MCL \quad \Leftrightarrow \quad \Delta_t = 1 - \frac{MCN_t}{MRN_t} \tag{19}$$

If $\Delta = 0$, the model exactly accounts for the observed data. Then, from an econometric perspective, the closer is the "error" Δ to zero, the better is the "goodness of fitness" of our theoretical economy.

3 Empirical results from the accounting exercise

Finally, in this section we conduct a quantitative evaluation of our theoretical economy. To this end, we first fix some parameters and give values to the model variables. Then, in order to evaluate the impact of each tax/benefit-related variable, we propose the following decomposition. First, we introduce only search costs in

the measure of the marginal return of employment. In this way we evaluate the country-specific dynamics of the labor market tightness. In a second step, our objective is to measure the relative impact of fiscal variables, so we introduce only the country-specific dynamics of taxes. Next, we assess the relative role of some country-specific labor market institutions, to know: the separation rate, the bargaining power and the unemployment benefits. This modifies both the marginal return of employment and the marginal cost of employment. Finally, in order to assess the global impact of the tax/benefit systems, we consider simultaneously both sources of heterogeneity: the labor market institutions and taxation.

3.1 Parameterization

Data on consumption, gross domestic product (GDP), employment, unemployment, population, wages and salaries, compensation of employees, the deflator of consumption and the deflator of GDP (base year 2000) are from the OECD. Series for hours worked are from the Groningen Growth and Development Center and the Conference Board,[5].

The discount parameter is such that $\beta = 0.985$. The elasticity of the matching function with respect to vacancies is equal to $\psi = 0.6$ (Blanchard and Diamond 1992). The ratio of aggregate recruiting expenditures to output ($\omega_t V_t / Y_t$) equal 1% (Andolfatto 1996). $\alpha = .4$ and $\sigma = 2$ (Ohanian, Raffo, and Rogerson 2006). We set ω equal to the mean over both time and countries. The unemployment benefits are computed as the product of the average replacement rate (Bassanini and Duval 2006) and the wage rate net of taxes. We also take into account the heterogeneity in the separation rate, s_i, which is calibrated in order to reproduce in each country the average unemployment duration for the 1985-1994 period estimated by Blanchard and Portugal (2001). This is done as follows. Using data for employment $N_{i,t}$ and unemployment $U_{i,t}$, we can compute the series of job destructions, $D_{i,t}$ and job creations, $M_{i,t}$, as:

$$D_{i,t} = s_i N_{i,t-1} \tag{20}$$

$$M_{i,t} = p_i U_{i,t-1} \tag{21}$$

[5] *Total Economy Database, January 2007:* http://www.ggdc.net

where p_i is the inverse of the average unemployment spell. Moreover, we have that:

$$M_{i,t} = N_{i,t} - N_{i,t-1} + D_{i,t} \tag{22}$$

Then, we deduce that:

$$s_i = 1 + \frac{p_{i,t}U_{i,t-1} - N_{i,t}}{Ni, t-1} \tag{23}$$

The average unemployment spells and the corresponding destruction rates are summarized in table 1.

Table 1: Unemployment duration and the job destruction rate.

Country	Belgium	Spain	France	Italy	Netherlands
$\frac{1}{p}^*$ (months)	23	41	20	30	20.5
s (%)	5.72	6.15	6.10	5.80	3.60
Country	Austria	Finland	Sweden	United Kingdom	United States
$\frac{1}{p}^*$ (months)	7	7	5	10	2.5
s (%)	5.49	16.09	13.39	10.40	30.48

*: *Source*: Blanchard and Portugal (2001). The authors construct monthly flows into unemployment as the average number of workers unemployed for less than one month, for the period 1985-1994, divided by the average labor force during the same period. The source of these data is the OECD duration database. Unemployment duration is constructed as the ratio of the average unemployment rate for the period 1985-1994 to the flow into unemployment.

Next, according with our model we compute series for the rate at which workers are matched with a vacant job as:

$$\Psi_t = \frac{M_t}{U_{t-1}} \tag{24}$$

where U is the observed unemployment level. Then, using the definition of the matching function we derive the market tightness (θ) and the rate at which vacancies are matched with searching workers (Φ):

$$\theta_t = \Psi_t^{\frac{1}{\psi}} \tag{25}$$

$$\Phi_t = \theta_t^{\psi-1} \tag{26}$$

3.2 The role of search costs

The higher the unemployment rate, the higher is the probability to find a worker for a firm. Hence, in economies with high unemployment, search costs paid by firms are low. In order to evaluate the magnitude of the search costs, we set the cost of a vacancy to its country-average value, whereas the tax wedge, the unemployment benefits and the bargaining power of workers are all settled equal to zero. Because our simple model does not introduce endogenous job separation, we set a constant heterogeneity in the separation rate: $s = E_i[s_i]$, where i denotes the country. Then we compute the the "error" series Δ_i as $\Delta_{i,t} = 1 - \frac{MCN_{i,t}}{MRN_{i,t}}$. Results from this exercise are displayed in figure 7.

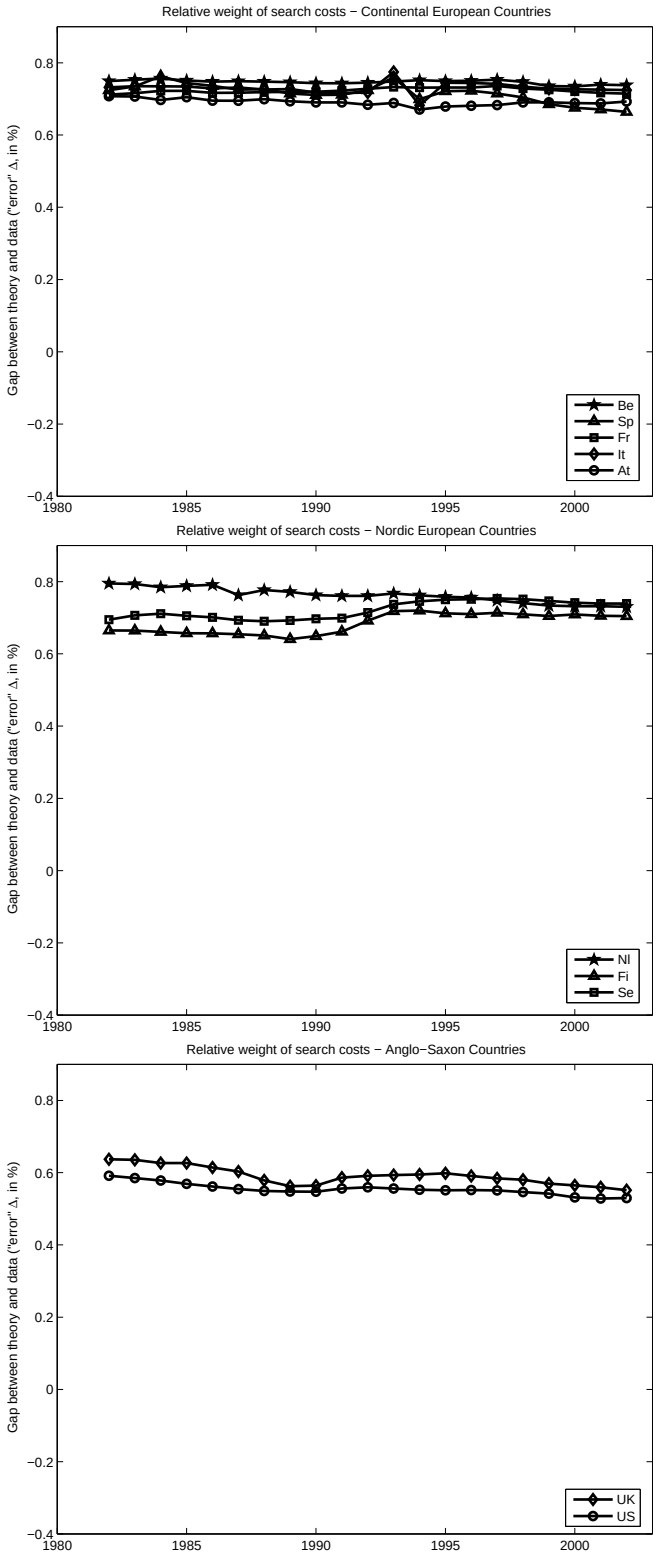
Since the search costs are lower in countries with high unemployment, and *vis-ceversa*, it is natural to find larger errors in Central and Nordic countries than in the Anglo-Saxon countries, where the unemployment rate is significantly smaller, so that the value of an employee is relatively higher than in the other countries because the search cost is higher for firms. However, even in the Anglo-Saxon counties the "error" series Δ still large because the weight of search costs is quite fair (according to the construction and parameterization of this variable).

3.3 The role of fiscal policy

In order to quantitatively assess the relative weight of taxes on the observed employment dynamics, we set the labor market indicators to zero and we allow for positive taxation. So firms have absolute bargaining power whereas the reservation wage is just the marginal rate of substitution between employment and consumption, net of taxes. Since in this configuration the search is a costless process ($\omega = 0$), there are not intertemporal returns from labor.

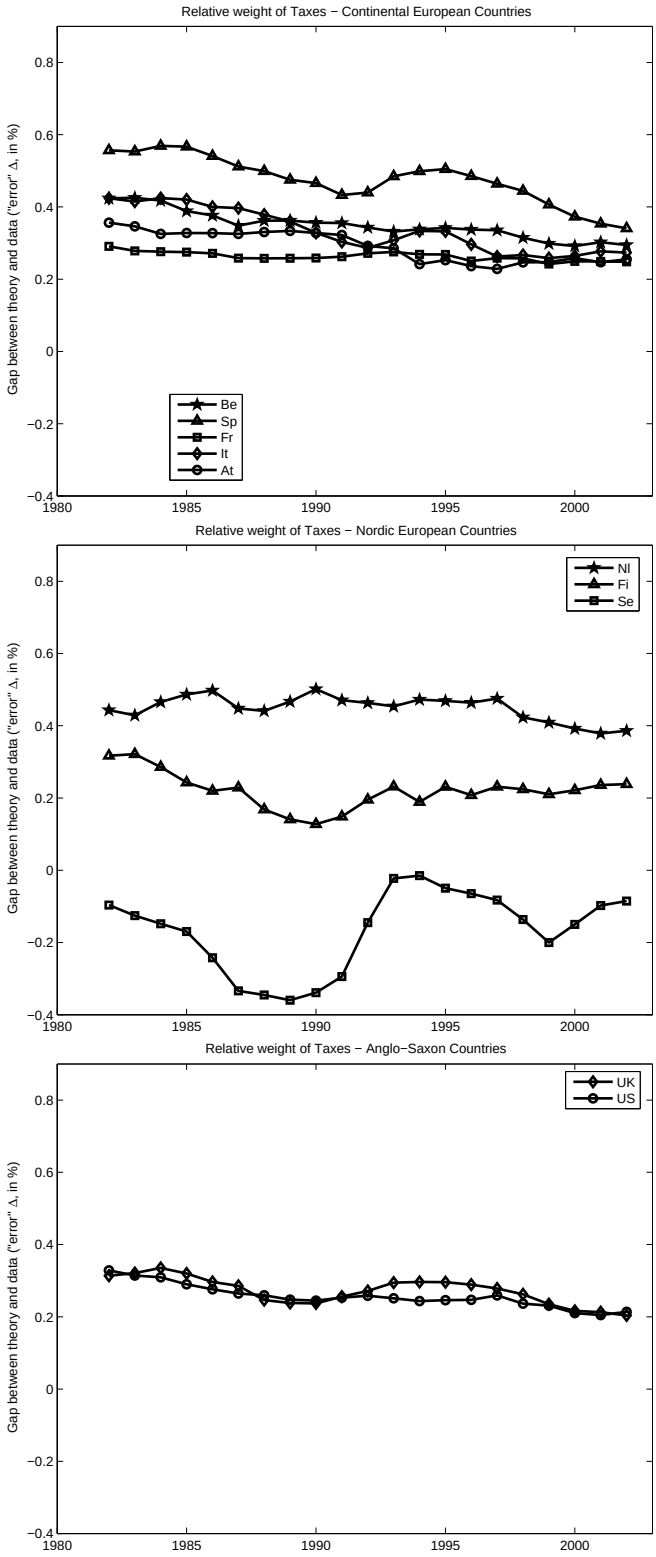
As before, we compute the series Δ_i. According to figure 8, the effect of taxes is not negligible, being particularly important in the Anglo-Saxon countries, in Finland, in France and in Austria (and even in Italy and Belgium after 1992) where taxes seems explain about 80% of the employment dynamics.

Figure 7: Costs of search and matching



In this configuration we set $\tau_{c,t} = 0$, $\tau_{w,t} = 0$, $\tau_{f,t} = 0$, $1 - \epsilon_{i,t} = 0$, $arr_{i,t} = 0$, $s_i = E_i[s_i] \; \forall \; i$ and $\omega > 0$.

Figure 8: Tax rates



In this configuration we set $\tau_{c,t} > 0$, $\tau_{w,t} > 0$, $\tau_{f,t} > 0$, $1 - \epsilon_{i,t} = 0$, $arr_{i,t} = 0$, $s_i = 0$ and $\omega = 0$.

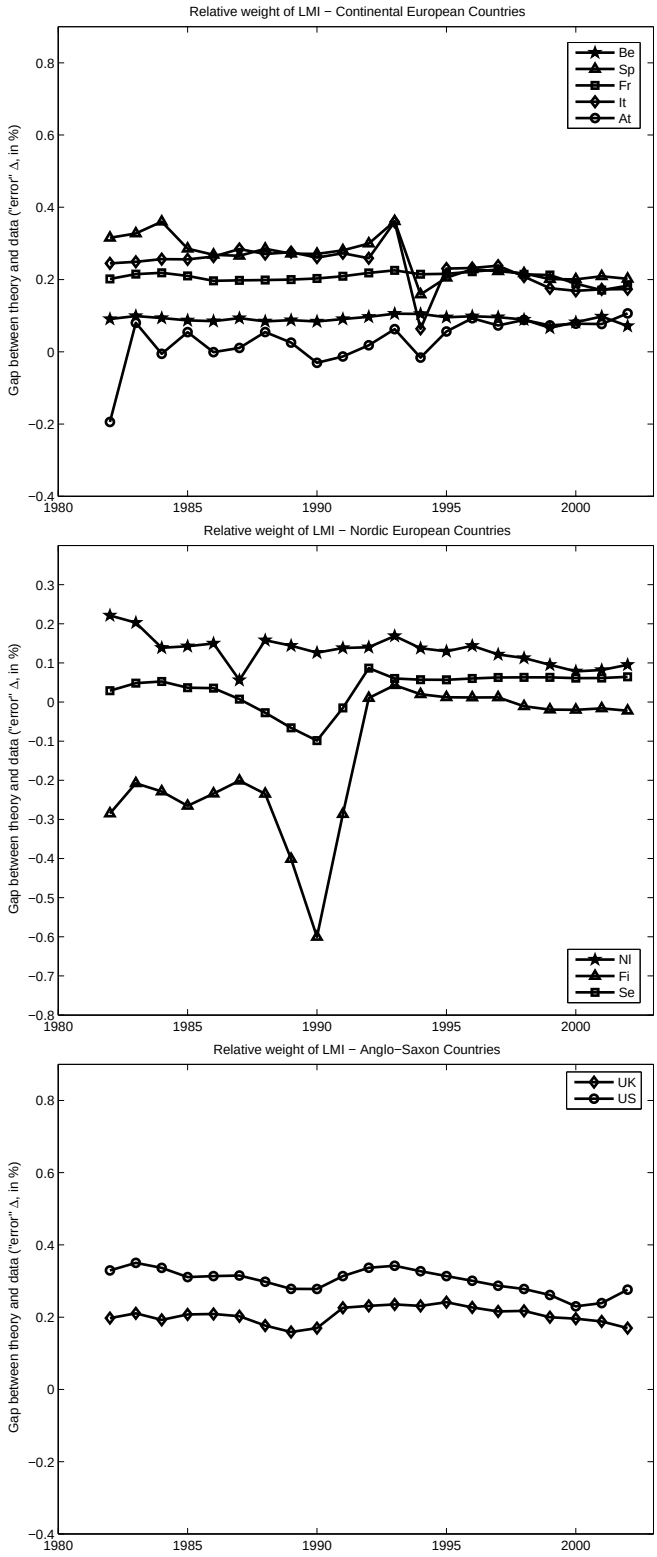
3.4 The role of labor market institutions

Now we assess the role of labor market institutions on the employment dynamics. To this goal we set all taxes equal to zero and we introduce our country specific labor market indicators. In doing so we can evaluate the impact of the heterogeneity across countries of labor market institutions. The Δ_i series are reported in figure 9. The effect of these country-specific labor market indicators is sharper than the effect of taxes in all the European countries (Central, Nordic and the United Kingdom). Then, when the labor indicators point to the existence of high real rigidities, the introduction of such variables in the theoretical model largely improves its fit. Conversely, in the United States the observed labor market indicators are the lowest, so that they have the smallest impact on the employment dynamics. Summing up, this experience clearly shows that in all countries, the "errors" are largely reduced when we take into account the country-specific heterogeneity of the labor market indicators. In particular, in Sweden the model seems account for all the employment dynamics (the "error" is around zero over the whole period), whereas in Belgium and Austria the fit is of more than 90%.

3.5 The joint impact of taxation and labor market institutions

Finally, in this last configuration, we allow for full heterogeneity across countries, so we introduce simultaneously the time-varying country-specific taxation and labor market institutions. For most countries, this exercise produces the best fit (see figure 10), explaining almost the totality of the trend changes in the employment rate in Belgium, France, Austria, the United States and in the United States. The improvement with respect to the two previous economies is in part due to the underestimation of the real wage when the model is evaluated without taxes. However, the goodness of fitness for Sweden is worst than with only labor market institutions during the first part of the period. Similarly, the Spanish and the Italian economies show large wedges between theory and data at the beginning of the 80s. These large errors at the beginning of the period may come from a particular initial condition explained by institutional specificities: the end of the dictatorial Franco's regime in

Figure 9: Labor market institutions



In this configuration we set $\tau_{c,t} = 0$, $\tau_{w,t} = 0$, $\tau_{f,t} = 0$, $1 - \epsilon_{i,t} > 0$, $arr_{i,t} > 0$, $s_i > 0$ and $\omega > 0$.

Spain in the middle of the 70s, and for Italy, the large size of the informal sector during the 60s and the 70s.

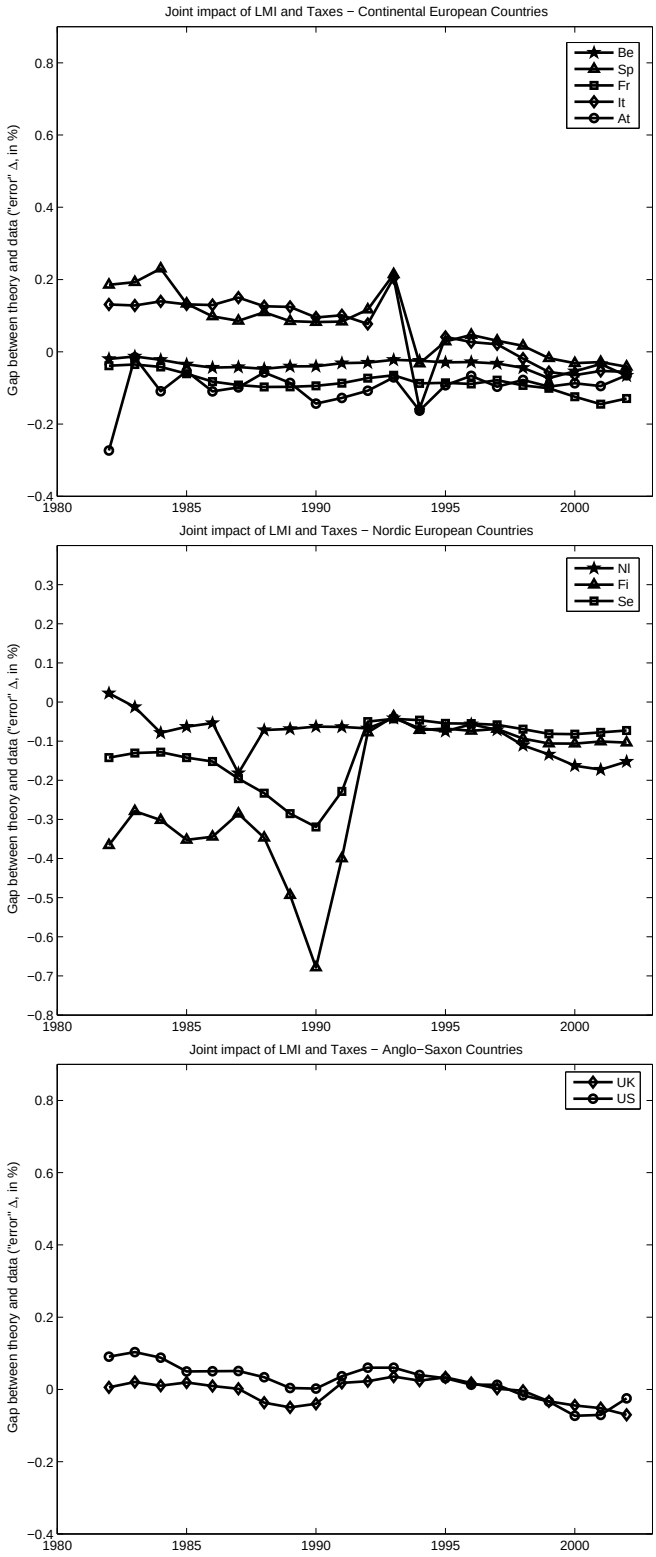
4 Concluding comments

In this paper we have conducted an accounting exercise to explain the observed dynamics of aggregate hours of market work of a sample of ten industrialized countries. On the one hand, since the 70s the aggregate work effort has been declining in Nordic and Central European countries, relative to the United Kingdom and the United States. On the other hand, we observe large differences even among Nordic and Central European countries. A main source of heterogeneity between countries are their tax/benefit systems. This, together with the fact that since the 80s the employment dynamics have largely shaped the dynamics of the aggregate hours of market work, have oriented our approach: we have proposed an explanation of the aggregate hours through the relative impact of several tax/benefit-related variables on the employment rate.

Our results show that the evolution of the labor market institutions explain most of the employment rate dynamics in the Central European countries and in the Nordic countries after around 1992. Conversely, taxes have a major role in explaining the employment dynamics in the Nordic countries. When we allow for a full heterogeneity (*i.e.* taxes and institutions), the model accounts for more than 80% of the trend changes in aggregate hours worked in most countries.

How to explain the remaining 20% not accounted by the model? The range of possibilities is large. Without being exhaustive, we can highlight some of them. First, this simple model is not accounting for the evolution of the number of hours worked per employee. Langot and Quintero-Rojas (2008b), for instance, take into account both margins in a shorter sample of countries, obtaining a slightly better fit. Second, our model also abstracts from the participation decision, which is another important issue because this margin could be also largely sensitive to tax and transfer programs such as policies on retirement or disability. On this point, Langot and Quintero-Rojas (2008a) have quantified the relative importance of the extensive and intensive margins on the observed differences across countries in aggregate

Figure 10: Taxes and labor market institutions



In this configuration we set $\tau_{c,t} > 0$, $\tau_{w,t} > 0$, $\tau_{f,t} > 0$, $1 - \epsilon_{i,t} > 0$, $arr_{i,t} > 0$, $s_i > 0$ and $\omega > 0$.

hours worked. Their counterfactual exercises show that the two dimensions of the extensive margin, the employment rate and the participation rate, explain the most of the total gap between regions. Finally, in some extent errors could come from the inexact measure of the labor market indicators, such as the bargaining power of workers or the job-separation rates. Nevertheless, from a transatlantic perspective, our accounting experiences show that the lower aggregate hours of market work observed in the European countries is mainly due to the real rigidities induced by labor market institutions.

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