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Abstract

This paper measures the impact of labor market policies (LMPs) on regular employment. Contrary to previous empirical studies, we conduct an econometric analysis based on sound theoretical foundations. The specification is based on an equilibrium job search model where LMPs affect tightness on the labor market. The impacts of a comprehensive set of LMPs on the regular employment rate and on wages are jointly estimated. Taking care of the endogeneity of LMPs, our results for Belgium indicate that unemployment benefits have a positive, yet small, impact on wages and a negative one on the employment rate. The rate of sanctions has a small negative effect on wages. Their impact on the employment rate is however negative. This can be understood if the efficiency of the sanctioned in the matching process is sufficiently lower than the one of the insured unemployed. Training programmes have a small negative effect on wages and a small positive one on employment. Our analysis also shows that the results can be sensitive to the choice made about the exogeneity of LMPs.

Keywords: evaluation; labor market policies; wage bargaining; equilibrium unemployment; equilibrium search.

JEL classification : J63, J64, J65, J68.

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1 Introduction

The employment guidelines of the European Council Resolution at the end of 1997 called notably for a clear shift towards more 'active labor market policies' (ALMPs). In many countries, given the strict financial constraints upon public and social security expenditures, the following questions have become more acute : What type of ALMPs should be developed and what is the appropriate balance between financial means spent on ALMPs and on 'passive labor market policies' (PLMPs)? Much attention has been paid to the microeconomic influence of labor market policies (LMPs) on the functioning of the labor market (see Pedersen and Westergard-Nielsen, 1993, OECD, 1993, Calmfors, 1994). Much less effort, as argued by Calmfors and Lang (1993), has been devoted to the measurement of the macroeconomic effects of these labor market policies. This paper is concerned with the latter.

The literature on the macroeconomic effects of LMPs can be classified under two main headings. Due to space limitation, we only provide a selective and highly condensed review of some contributions. Some sophisticated theoretical analyses have been developed where the link between either PLMPs or ALMPs and wage formation has been emphasized (see e.g. Holmlund and Lundborg, 1989, Holmlund and Lindén, 1993, Calmfors and Lang, 1993, 1995). In the case of ALMPs, two effects go in opposite directions. First, they are supposed to enhance or at least maintain effective labor-force participation. Second, these policies typically reduce the disutility of being laid off and this effect pushes wages upwards and employment downwards. By 'employment', the theoretical literature actually means employment in profit maximizing firms. This indicator is also called 'regular employment'. It does not include the number of individuals occupied in the various ALMPs.

The empirical literature can be classified according to the evaluation criterion used. Some papers have analyzed the effect of LMPs on wages. They often conclude that ALMPs have a wage-push effect. This evidence has been recently questioned for Sweden by Forslund and Kolm (2000). To estimate the effect of LMPs on the unemployment rate or the unemployment exit rate, a matching function or a Beveridge curve is augmented with some labor market policy indicators (see e.g. Haskel and Jackman, 1988, Jackman, Pissarides and Savouri, 1990, Boeri and Burda, 1996, Dor, Van der Linden and Lopez-Novella, 1997 and the contributions in de Koning and Mosley, 2001). This approach can be criticized on at least three grounds. First, it only provides an estimation of the parameters of interest given the vacancy (or the unemployment-vacancy) level. Yet, the theoretical literature emphasizes that labor market policies should have an impact on wage-setting and hence on the number of vacant jobs. Moreover, in many countries, the vacancies registered by Employment Agencies are not very reliable. They represent a varying (and sometimes highly selective) proportion of the actual number of vacancies in the economy. Finally, the lack of a theoretical foundation has the consequence that this empirical literature is presumably guided too much by 'what the observable data tell'.

This paper uses time-series data to estimate the impact of LMPs on the regular employment rate. Contrary to most of earlier empirical papers that focussed either on ALMPs or on PLMPs, the effects of PLMPs and ALMPs are here jointly estimated. Moreover, the specification of the estimated model is very different and, to us at least, more appropriate. We do not specify a model conditional on a set of LMP indicators and on the ratio between vacancies and the number of job searchers ('tightness' on the labor market). Instead, following the afore-mentioned theoretical literature, we replace the latter ratio by its determinants. These are the LMP indicators and a list of structural variables (such as the job destruction rate). This approach requires to isolate the relevant variables and to derive the theoretical sign of their net effect on tightness. For this purpose, Section 2 generalizes the basic equilibrium job search model of Pissarides (2000) by considering four labor market states : Insured unemployment, uninsured unemployment, training and regular employment. The literature based on the Pissarides approach has sometimes calibrate his model and produced simulation results (see e.g. Mortensen and Pissarides, 1999). However, we are not aware of previous attempts to estimate an econometric model derived from the Pissarides model.

Section 3 presents the original data set we have gathered for Belgium. The choice of this country was motivated by the availability of long time-series data that display sufficient variability within the sample. It should first be emphasized that long time series of administrative data covering a comprehensive set of LMPs are rarely available. In the case of Belgium, we are able to jointly analyze the effect of training programs, unemployment benefits and sanctions (i.e. insured unemployed people who lose their benefits for various reasons). Second, Belgian data on LMPs interestingly present a lot of variation. After two jumps during the seventies, the average replacement ratio has sharply declined during the eighties (from about 0.45 to 0.35). The number and the rate of sanctions fluctuate a lot with a sharp increase at the beginning of the nineties. The effort put into training has substantially increased during the eighties and nineties.

The empirical results are summarized in Section 4. In this analysis we take care of biases that could result from the endogeneity of LMPs (see e.g. Calmfors, 1994). Section 5 concludes the paper.

2 Labor market policies and equilibrium tightness on the labor market

The aim of this section is to identify the determinants of tightness and of the equilibrium employment rate. These determinants will be used in Section 4 to specify an econometric model. This section shows that many LMPs have a clear-cut effect on tightness but not on the equilibrium employment rate. The empirical exercise of Section 4 will allow to sign these theoretically ambiguous effects. Since we intend to estimate the impacts of both PLMPs and ALMPs, our model has to be sufficiently general to deal with both passive and active measures. The main features of the theoretical model developed below are relevant for most industrialized countries. Some specific assumptions are however introduced to fit the Belgian institutional context.

2.1 A theoretical framework for the analysis of LMPs

This section extends the theoretical matching model of Pissarides (2000) to the case of four states on the labor market : Insured unemployment, uninsured unemployment, training and regular employment ('employment' for short). The first two states are distinguished in order to emphasize the role of sanctions on the equilibrium employment rate. Some of the unemployed do not receive unemployment insurance (UI) benefits for two broad reasons. Either they are not entitled (e.g. because their past record of insured employment is too short) or benefit has ceased to be paid (e.g. because of a misconduct or of limited duration of entitlement). In this model, we focus on the latter reason (called 'sanctions').[1] The third state identifies the formerly unemployed who are being trained.[2]

This model draws upon Holmlund and Lindén (1993) who distinguish three states : Unemployment, 'relief jobs' (i.e. direct job creation for the unemployed, in the public and non-profit sector) and 'regular' employment. On the labor market, there are important information imperfections and frictions related to various heterogeneities. These are not explicitly modeled but are summarized by the matching technology. Therefore, although

[1] Considering sanctions only is appropriate for Belgium where only 5% of claimants were considered as ineligible to UI benefits during the nineties.

[2] More generally, this state could identify other ALMPs (see Van der Linden and Dor, 2001).

the model formally deals with homogeneous workers and jobs, the matching function will capture in a convenient way heterogeneities that are present both on the supply and the demand sides of the labour market. Assume a continuous-time setting. The flow of hires, H, is a function of the number of job-seekers, S, and the number of vacancies, V. Let $H = h(S, V)$ be the aggregate matching function. It is now standard to assume this function to be increasing, concave and homogeneous of degree 1. S is not simply the sum of the number of insured unemployed, U, the number of trainees, R, and the number of uninsured unemployed, X. These jobless workers are presumably not equivalent as far as the matching process is concerned. So, S has to weight the various types of workers in order to measure 'efficiency units'. To this end, each type of job-seeker receives a specific 'matching effectiveness parameter' $c_i, i = u, r, x$ ('effectiveness' for short). For tractability reasons, these parameters are taken as exogenous. We will come back to that assumption at the end of this section. With these notations, the number S of job-seekers (measured in efficiency units) is $c_u U + c_r R + c_x X$.

The labor force is made up of L individuals (L is exogenously given and $L \equiv E + U + X + R$, where E denotes employment). Let lower case letters e, u, x and r denote the rates of individuals in the various states (e.g. $e \equiv \frac{E}{L}$). Let tightness on the labor market (i.e. the ratio $\frac{V}{S}$) be denoted by θ. It should be emphasized that tightness is measured in efficiency units. The rate at which vacant jobs become filled is $q(\theta) \equiv H/V = h(\frac{1}{\theta}, 1), q'(\theta) < 0$. Let the hiring rate be defined as $\frac{h(S,V)}{S} = \theta q(\theta)$ and denoted by $\alpha(\theta)$ with $\alpha'(\theta) > 0$.

Figure 1 summarizes the flows between the four states. The arrival rate of job offers is $c_u\alpha$ for an insured unemployed worker, $c_x\alpha$ for an uninsured unemployed and $c_r\alpha$ for a trainee. Although c_u, c_x and c_r are parameters, the job arrival rates are endogenous because they vary with θ. As will soon be clear, the parameters of the model are such that a job is always preferred to each of the three other states. Each job match is assumed to be subject to the same exogenous rate of termination ϕ. Any worker whose job is terminated is assumed to be eligible for UI.[3] To enter a training scheme, a jobless worker has to transit into the insured unemployment state.[4] γ denotes the exogenous arrival rate of training offers.[5] The parameters of the problem will be such that the unemployed always find

[3] In the Belgian context, it can be assumed that laid-off workers receive UI benefits.

[4] This assumption fits the Belgian rules rather well. Holmlund and Lindén (1993) deals with the possibility that those separated from a job enter directly a relief job.

[5] In Belgium, the unemployed who apply for a training scheme have to queue until a 'training slot' becomes available (Cockx and Bardoulat, 1999). This supports our way of modeling.

interesting to enter a training scheme. A training program ends at an exogenous rate λ.[6] It is assumed that $\lambda \geq \phi$.[7] Finally, there is a limited duration of entitlement to UI. Recipients have their benefit terminated at an exogenous rate π.[8] In that case, they are entitled to a (lower) assistance benefit for an indefinite duration. Once UI benefit is exhausted, a worker must be hired before he becomes eligible again.[9] Uninsured unemployed have no access to training schemes.[10]

The relative value of the c_i parameters is important. We argue that training programs typically improve human capital or they 'signal' more productive workers.[11] Furthermore, compared to the unemployed, trainees often have closer contacts with the Public Employment Services and with firms (where some of them are trained). This arguably gives them an informational advantage. It is very plausible that these effects outweigh the reduction of time available for searching, so that $c_r \geq c_u$.

Consider now the relative value of c_x with respect to c_u. First, it has been argued that compared to non-claimants "benefit claimants maintain a closer attachment to the labour market and appear more able to prolong search effort" (Wadsworth, 1991). See also Blau and Robins (1990). Second, the unemployed enter the state of uninsured unemployment (X) after being insured unemployed (U). Therefore, discouragement can explain why their effectiveness parameter is lower (see Calmfors and Lang, 1995). A third argument is concerned with the rate of job offers. A ranking of job-applicants according to their unemployment duration or according to their status (being sanctioned may be a signal of

[6]Since the model is markovian, a spell in training does not affect the characteristics of workers once they have moved to other states (e.g. when they are back into unemployment).

[7]This assumption is supported by casual data from the administrations in charge of training schemes and by the results in Cockx and Bardoulat (1999) and Cockx, Van der Linden and Karaa (1998).

[8]To motivate this modeling, notice that there is evidence that a substantial share of Belgian insured unemployed ignores the rules according to which they can be sanctioned (De Lathouwer, Bogaerts and Perelman, 2000). Moreover, these rules let some discretionary power to local public employment agencies that implement them.

[9]Other analyses of the general equilibrium impact of sanctions have been developed by Atkinson (1995), Ljungqvist and Sargent (1995) and Boone and van Ours (2000). Our model can also be related to Fredriksson and Holmlund (2001) and Cahuc and Lehmann (2000) who use a matching framework to analyze the profile of the replacement ratio as a function of unemployment duration. Abbring, van den Berg and van Ours (1999) develop a job-search model with probabilistic sanctions (understood as a permanent decrease in unemployment benefits). Our theoretical setting could be extended to the case of temporary sanctions. This would complicate the model without adding much insight.

[10]This is in accordance with stylized facts in Belgium.

[11]For Belgium, Cockx and Bardoulat (1999) concludes that training programs substantially improve the hiring rate of the beneficiaries.

bad characteristics such as a low attachment to the labour market) can also be invoked to justify that the uninsured unemployed receive less job offers than the insured ones. Nevertheless, it could be argued that uninsured unemployed turn down less offers because their reservation wage must be lower or that they search more intensively. However, there is a growing evidence that the unemployed turn down very few offers (see van den Berg, 1990, Devine and Kiefer, 1991, Warren, 1997 and Table 4.2 in OECD, 2000). In addition, there is at least some evidence that search intensity is not much influenced by the level of benefits (see Schmitt and Wadsworth, 1993). So, the assumption $c_u > c_x$ is arguably the most realistic one.

The assumption $c_r \geq c_u > c_x$ combined with a very plausible ranking of the respective replacement ratios (see below) will allow clear-cut conclusions about the direction in which LMPs affect *tightness* on the labor market.[12]

The model is developed in a steady state. The flows between the four states on the labor market keep e, u, x and r constant. These conditions lead to the following expressions :

$$(c_r\alpha(\theta) + \lambda)r = \gamma u, \tag{1}$$

$$\phi(1 - u - r - x) = \alpha(\theta)(c_u u + c_r r + c_x x), \tag{2}$$

$$c_x\alpha(\theta)x = \pi u. \tag{3}$$

Let $\Delta \equiv [(c_u\alpha(\theta) + \pi + \phi)(c_r\alpha(\theta) + \lambda) + \gamma(c_r\alpha(\theta) + \phi)]\, c_x\alpha(\theta) + \phi\pi(c_r\alpha(\theta) + \lambda)$. For a given value of θ, equations (1), (2), (3) and the identity $e \equiv 1 - u - r - x$ determine e, u, x and r. In particular,

$$e = [(c_u\alpha(\theta) + \pi)(c_r\alpha(\theta) + \lambda) + \gamma c_r\alpha(\theta)]\, c_x\alpha(\theta)\Delta^{-1}, \tag{4}$$

$$u = \phi c_x\alpha(\theta)(c_r\alpha(\theta) + \lambda)\Delta^{-1}. \tag{5}$$

Equation 4 defines an increasing relationship between e and θ.

[12] As far as tightness is concerned, if the assumption $c_r \geq c_u > c_x$ was rejected, the same qualitative conclusions could also be reached provided that the conditions on the relative replacement ratios become more restrictive.

Proposition 1. *For a given level of tightness measured in efficiency units, the regular employment rate e increases with the parameters c_u, c_x, c_r and with the rate ϕ. Moreover, under the assumption $c_r \geq c_u > c_x$, e is an increasing function of the rate γ and a decreasing function of λ and π (see also Table 1).*

Proof. See Appendix 1. ∎

So, if $c_r \geq c_u > c_x$, increasing the rate of entry into training programs will improve the employment rate as long as θ remains unchanged. Increasing the rate of sanctions has the opposite effect. These properties are quite intuitive.

To derive θ, we now turn to the determination of vacancies and wages. When the presentation draws heavily upon Holmlund and Lindén (1993), it will only set out the essentials. The number of vacancies is chosen by the firms. If a job terminates, the firm and the worker will have to engage in a costly search process before they can meet another partner. This gives rise to a rent that will be shared according to the Nash solution to a bargaining over wages. Assume that firms are homogeneous and that each firm has only one job. The firm's discounted expected return from an occupied (respectively, vacant) job is denoted J_o (respectively J_v). Let δ be the discount rate, y the constant marginal product of a filled vacancy, w_c the real cost of labor and k the fixed cost of a vacant job per unit of time. J_o and J_v satisfy two familiar conditions :

$$\delta J_o = y - w_c + \phi(J_v - J_o), \tag{6}$$

$$\delta J_v = -k + q(\theta)(J_o - J_v). \tag{7}$$

In equilibrium, vacancies are opened as long as they yield a positive expected return. Therefore, the equilibrium condition for the supply of vacancies is $J_v = 0$. Using (6) and (7), this equilibrium condition can be rewritten as :

$$y = w_c + \frac{(\delta + \phi)k}{q(\theta)}. \tag{8}$$

This relationship, the 'vacancy-supply curve', says that the marginal product of a filled vacancy should be equal to the wage cost plus the expected capitalized value of the hiring cost. Conditional on y, δ, ϕ and k, equality (8) defines the feasible wage cost as a function of θ (if the labor market becomes more tight, i.e. θ increases, the cost of filling a vacancy increases; hence the wage cost that the firm can afford decreases, too).

Let Λ_e, Λ_u, Λ_x and Λ_r be the present-discounted value of the expected income stream of, respectively, an employed worker, an insured unemployed, an uninsured unemployed and a trainee. Assume linear taxes. If w denotes the real net wage, $w_c \equiv w(1+\tau)$. In a steady-state equilibrium, the four expected lifetime incomes are related by the following conditions :

$$\delta\Lambda_e = w + \phi(\Lambda_u - \Lambda_e), \tag{9}$$

$$\delta\Lambda_u = b_u + c_u\alpha(\Lambda_e - \Lambda_u) + \gamma(\Lambda_r - \Lambda_u) + \pi(\Lambda_x - \Lambda_u), \tag{10}$$

$$\delta\Lambda_r = b_r + c_r\alpha(\Lambda_e - \Lambda_r) + \lambda(\Lambda_u - \Lambda_r), \tag{11}$$

$$\delta\Lambda_x = s + c_x\alpha(\Lambda_e - \Lambda_x), \tag{12}$$

where b_u, b_r and s denote respectively the unemployment benefit, the benefit paid to the trainees and the assistance benefit. We assume that these benefits are proportional to wages. Let ρ_u, ρ_r and σ be the corresponding replacement ratios ($\rho_u \equiv \frac{b_u}{w}$, $\rho_r \equiv \frac{b_r}{w}$ and $\sigma \equiv \frac{s}{w}$). The choice of these benefit levels has to be incentive compatible. Given that by assumption $c_r \geq c_u > c_x > 0$, the conditions $1 > \rho_r \geq \rho_u \geq \sigma \geq 0$ are sufficient to guarantee that $\Lambda_e > \Lambda_r > \Lambda_u > \Lambda_x$. This can be seen by solving equations (9) to (12)(see Appendix 1 for a proof). In particular, $\Lambda_e - \Lambda_u = wf(\alpha(\theta), Z)$ where $f(\alpha(\theta), Z)$ is defined as :

$$\frac{(\delta + c_x\alpha)\left[(1-\rho_u)(\delta + c_r\alpha + \lambda) + \gamma(1-\rho_r)\right] + \pi(\delta + c_r\alpha + \lambda)(1-\sigma)}{(\delta + c_x\alpha)\left[(\delta + c_r\alpha + \lambda)(c_u\alpha + \phi + \delta) + \gamma(c_r\alpha + \phi + \delta)\right] + \pi(\delta + c_r\alpha + \lambda)(\phi + \delta + c_x\alpha)}, \tag{13}$$

with $\alpha = \alpha(\theta)$ and $Z \equiv (\delta, c_u, c_x, c_r, \gamma, \lambda, \phi, \pi, \rho_u, \rho_r, \sigma)'$. It is immediately seen that expression (13) is positive.

The wage rate is derived from the maximization of the following Nash product :[13]

$$\max_w \left(\Lambda_e - \Lambda_u\right)^{\beta} \left(J_o - J_v\right)^{1-\beta}, \tag{14}$$

with $0 < \beta < 1$. The first-order condition can be written as :

$$y - w_c = \frac{1-\beta}{\beta}(\Lambda_e - \Lambda_u)(\delta + \phi)(1+\tau) \tag{15}$$

[13] Wages can be renegotiated at any time. So, whatever his previous state on the labor market, the fallback level for a worker is the position of insured unemployment.

The higher the difference in expected value between employment and insured unemployment the lower the negotiated wage. Combining (15) and (13) leads to the following wage-setting relationship between the wage cost and tightness θ:

$$w_c = \frac{y}{1 + \frac{1-\beta}{\beta}(\delta + \phi) f(\alpha(\theta), Z)}. \tag{16}$$

This relationship between w_c and θ is upward-sloping because $\frac{\partial f}{\partial \alpha} < 0$ (a proof is provided in Appendix 1). Alternatively, combining (8), (15) and (13) yields:

$$w_c = \frac{\beta k}{(1-\beta) q(\theta) f(\alpha(\theta), Z)}. \tag{17}$$

The upper part of Figure 2 illustrates the two equilibrium relationships (8) and (17) when k is a constant. This figure is easily adapted if k is proportional to w_c. The lower part of Figure 2 displays Equation (4). Finally, combining (8) and (17), it is easily seen that the equilibrium value of θ solves the following implicit equation :

$$[yq(\theta) - k(\delta + \phi)]\, f(\alpha(\theta), Z) = \frac{\beta}{1-\beta} k. \tag{18}$$

Hence the tax rate τ does not the equilibrium level of tightness θ (on this issue, see Holmlund (2000)).

2.2 Comparative-static properties of equilibrium

The comparative statics is summarized in Table 1. This table displays the sign of the effects of the 'labor market policies parameters' $(\gamma, \lambda, \pi, \rho_u, \rho_r, \sigma)$ and the 'structural parameters' of this economy $(c_u, c_x, c_r, \phi, \delta, k, \beta, y)$ on the equilibrium values of θ and e. The second column recalls Proposition 1. The third (respectively, the fourth) column indicates in which direction the wage-setting curve (17) (respectively, the vacancy-supply curve (8)) shifts as the parameter increases. From the effects on the two latter curves, the influence on the equilibrium level of tightness θ is seen in the fifth column. The last column is devoted to the net effect on e. It combines the direct effect conditional on θ (column 2) and the indirect one through the change in θ.

Proposition 2. *Assume that $c_r \geq c_u > c_x$. Higher rates of training offers (γ) decrease θ but have an ambiguous net effect on the employment rate e. On the contrary, increasing the rate at which training programs end (λ) or the rate of sanctions (π) has a positive effect on θ and an ambiguous one on e. Finally, raising the replacement ratios (ρ_u, ρ_r, σ) decreases both θ and e.*

Proof. The proof of the effects on the wage-setting curves is left to Appendix 1. On the basis of these results, the proof of proposition 1 can be stated intuitively as follows. Recalling that θ is measured in efficiency units, the LMPs have no effect on the vacancy-supply curve. When they improve (deteriorate) the expected lifetime income in case of unemployment, they push the wage-setting curve upwards (downwards). Hence, the equilibrium value of θ decreases (respectively, increases). Raising γ improves the intertemporal discounted value of being unemployed. Hence, higher wages are bargained over (for a given value of tightness). With an unchanged vacancy-supply schedule, this eventually leads to a lower equilibrium value for θ. The same holds for the replacement ratios (ρ_u, ρ_r, σ). Since Equation (4) is not affected by the replacement ratios, e decreases with ρ_u, ρ_r, σ. On the contrary, increasing the rate of participation into programs has a direct positive effect on e (according to Proposition 1). Therefore, the net effect on e is ambiguous. Conversely, increasing the rate at which training schemes expire (λ) or increasing the rate of sanctions (π) deteriorates the position of the unemployed and leads to an increase in tightness θ. The ambiguous effect on e comes from the direct effect of Proposition 1. ■

Turning to 'structural parameters', an improvement in the effectiveness parameters (c_u, c_x or c_r) has a negative impact on the difference $\Lambda_e - \Lambda_u$ at given wage and tightness levels (see (13) and Appendix 1). Workers negotiate higher wages to compensate this effect (at given θ). Since, the vacancy-supply curve is left unchanged, the ultimate effect is a reduction in equilibrium tightness. Yet, because more effective job seekers have a direct favorable effect on e (Proposition 1), the net effect on the employment rate is ambiguous. More bargaining power given to the workers (β) also leads to higher wages and to lower equilibrium values for θ and e. The rate of job termination ϕ, the discount rate δ and the cost of posting vacancies are the only parameters that have an impact on both the vacancy-supply and the wage-setting curves. Increasing any of these parameters reduces the equilibrium expected return from an (occupied or vacant) job and therefore leads to the opening of less vacancies at given wages. Using (13), it can be checked that $\Lambda_e - \Lambda_u$ is a decreasing function of ϕ and δ at given wage and tightness levels (see also Appendix 1). To compensate this effect, workers negotiate a higher wage (at given θ). The combined shift of the wage-setting and vacancy-supply curves induced by an increase in ϕ or δ unambiguously lowers the equilibrium value of θ. The equilibrium employment rate shrinks, too. Finally, more productive matches (a higher y) raise J_o and therefore imply that more vacancies are posted at given wages. Since the wage-setting schedule (17) is unaffected, the equilibrium value of θ moves upwards. So does the employment rate.

Up to now we have assumed that each of the LMPs could be modified without affecting effectiveness (namely, the c_i's). This is questionable. Fredriksson and Holmlund (2001) develop a theoretical equilibrium search model where search intensity among the insured and the uninsured unemployed is endogenous (and therefore a function of the replacement ratio and the rate of sanctions). In this more general setting, they also find that the equilibrium level of θ increases with π and decreases with the replacement ratio. Therefore, we can conclude that the qualitative properties in Table 1 are fairly robust in this type of model.

The determinants of tightness in equilibrium can now be used to specify an econometric model for the employment rate. Before, let us introduce our original data set. This presentation will highlight some additional features that should be incorporated in the econometric analysis.

3 The data

The available data set covers the period 1961-1999 (see also Appendix 2). To measure regular employment E_t, we take employment in firms (wage earners and salaried employees, excluding the public sector). According to the theoretical model, we divide this employment level by the size of the *labor force* L_t. Let us call this ratio the 'firms' employment rate' (see Figure 3). This figure highlights cyclical fluctuations but also long-lasting shifts (for instance following the oil shocks).

All information about LMPs is measured on a civil year basis. The unemployment benefit system will first be characterized by an aggregate replacement ratio. We cannot observe both ρ_u, ρ_x and ρ_r. The available replacement ratio is equal to the average paid out (real) unemployment benefit, b_t, divided by the average real net wage rate, w_t (see Figure 3). This ratio will capture the evolution of most relevant allowances. Since the unemployment benefits are proportional to the wage rate (with lower- and upper-bounds), it is not surprising that b_t and w_t are correlated. Moreover, since the replacement ratio has sometimes been adapted in response to the rise in unemployment, we will have to take care of a possible dependency between b_t and the unemployment rate. The average replacement ratio has substantially increased during the seventies but is currently back to its level of the sixties.

In Belgium, the entitlement duration is usually said to be unbounded (see Chapter 2 of OECD, 1996). Nevertheless, conditional upon household's composition and income, benefit entitlement ceases if the length of the spell exceeds a regional- and duration-dependent criterion (see OECD, 1997).[14] In addition to this loss of entitlement due to a 'too long' unemployment spell, benefit may be withdrawn for a fixed period or permanently if for instance the individual is considered as unavailable for a job or if he refuses a suitable job offer.[15] The available measure of 'sanctions' is an aggregate indicator of all disqualifications (whether they are motivated by a 'too long' spell or by other reasons). The rate of sanctions π_t is measured by the ratio of the annual flow of disqualifications, EXC_t, and the total stock of insured unemployed, U_t. The plot of this series is presented in Figure 4. As an illustration of the simultaneity problem highlighted by Calmfors (1994), it can be seen that the number of sanctions often fluctuates with the level of unemployment.

There exists no long time series of the flow of entries into training programs. However, we have been able to construct a time series for the annual number of unemployed who *end* a training program organized or recognized by the Employment Agencies, T_t. This flow mixes returns into unemployment and exits from training towards employment[16]. From equation (1), we estimate γ by the ratio between T_t and the stock of unemployed. This variable clearly pools different types of training schemes, both within a given year and all along our sample period. Figure 4 shows the rapid development of training policies during the last fifteen years.

The rate of job termination leading to an unemployment inflow, ϕ, is approximated by the number of insured unemployed with a duration of less than three months, $U_t^{<3m}$, divided by the population at risk (the total number of wage earners and salaried employees, ET_t). This rate presents a clear break around 1974 (see Figure 5).

The discount rate is sometimes approximated by a long-term real interest rate. However, it turns out to be a poor empirical proxy. So we here assume that this structural parameter is constant.

In the theoretical model, y is the constant marginal product. We measure it by dividing real GDP by total employment (see Figure 5). Firms' employment is however also affected by business cycle conditions that are not entirely captured by GDP per head (which includes the quite large public sector). Therefore, business cycle indicators will be introduced (and denoted 'BCI').

[14]In that case, the individual has to work during at least a year before any further eligibility becomes possible (this length varies with age).

[15]In the permanent case, the previous footnote applies, too.

[16]Therefore, we are unable to measure λ.

The bargaining power of the workers (or their representative) β should also be included in this analysis. We feel that the degree of unionization is a very poor proxy in Belgium since this country has a system of mandatory extension of sectoral collective agreements to the entire industry. Moreover, unemployment benefits are administered more efficiently by unions than by the public agency. This clearly should affect unions' membership. So, in the specification presented below, we introduce another proxy for the bargaining power, namely the frequency of strikes. This variable measures the annual number of strikes ('strikes') divided by the size of the active population (see Figure 5). Until 1993, strikes are disaggregated according to two motives (wages and employment). The latter reason motivates between 30 and 40% of the strikes.

For tractability reasons, the theoretical model assumed workers and firms to be homogeneous. However, in order to explain the evolution of firms' employment during four decades, we have to take *compositional changes* into account. The share of women in regular employment (denoted by '*sharew*') has increased a lot (see Figure 5). Including this share among the regressors will capture both a supply-side effect, the development of part-time jobs and a sectoral shift (since the development of female employment parallels the one of the service sector). Furthermore, the substantial decrease of the firms' employment rate between 1974 and the mid-eighties coincides with a dramatic decline of the secondary sector that is not well captured by the variable '*sharew*'. Therefore, we will condition our estimation on an additional variable that measures the share of the secondary sector in aggregate value added, '*shares*' (see Figure 5).

4 The empirical analysis

4.1 The specification

Equation (4) can be rewritten as $e = \mathcal{E}_1(\theta, \gamma, \lambda, \pi, \phi, c_u, c_r, c_x)$. Moreover, Equation (18) can be rewritten as $\theta = \Theta(\gamma, \lambda, \pi, \phi, c_u, c_r, c_x, \rho_u, \rho_r, \sigma, y, \delta, \beta, k)$. Substituting this equation in the former leads to an equation $e = \mathcal{E}_2(\gamma, \lambda, \pi, \phi, c_u, c_r, c_x, \rho_u, \rho_r, \sigma, y, \delta, \beta, k)$. We log-linearize this equation and formally assume the constancy of k, δ, c_u, c_r, c_x.[17] We also

[17]In a sensitivity analysis (available upon request), we have assumed that k is a log-linear function of the wage cost (since a major part of the cost of opening vacancies is made of working hours spent on tasks such as advertising, screening of applicants and the like). The sign of the estimated parameters remain unchanged and their magnitude is nearly not affected. Hence, we will present the most parsimonious specification.

assume that the fluctuations of ρ_r and σ are well captured by the ones of the observable ρ_u. In the absence of data about λ, this leads to the following basic long-run specification for the firms' employment rate:

$$ln(e) = a_0 + a_1 ln(y) + a_2 ln(\phi) + a_3 ln(\gamma) + a_4 ln(\pi) + a_5 ln(\rho_u) + a_6 ln(\beta), \qquad (19)$$

or, using the notations introduced in the previous section,

$$ln(\frac{E}{L}) = a_0 + \mathbf{a_1 ln(y)} + a_2 ln(\frac{U^{<3m}}{ET}) + a_3 ln(\frac{T}{U}) + a_4 ln(\frac{EXC_t}{U}) + a_5 ln(\frac{b}{w}) + a_6 ln(\frac{\text{strikes}}{L}) \qquad (20)$$

where $\mathbf{ln(y_t)}$ will be replaced by a vector of indicators introduced in the previous section and $\mathbf{a_1}$ is now a vector, too.

According to the theoretical analysis the sign of a_1 should be positive and the ones of a_2, a_5 and a_6 negative. Following Proposition 2, the signs of a_3 and a_4 are a priori ambiguous under the hypothesis that $c_r \geq c_u > c_x$.

The descriptive analysis of the previous section suggested that the econometric analysis should carefully take care of simultaneity biases. The latter could come from two sources. First, there could be a reverse causality between the firms' employment rate (or the related unemployment rate) and the development of programs (γ, π, ρ_u). Second, many variables of interest have the level of unemployment at their denominator. For these reasons, we estimate a system of equations. The first equation will be based on Equation (20) in which the numerator and the denominator of each ratio are introduced explicitly. In this way, we will be able to add explicit relationships between the programs (the numerators of γ, π, ρ_u) and indicators of the labour market. Moreover, since the theoretical model emphasizes the role of LMPs on wages and because the level of unemployment benefits is related to the one of wages, a wage equation will be added to the system. A set of identities will close the model. Let us now present the specification in more details. For the moment we stick on long-run relationships.

In addition to Equation (20) extended to deal with compositional changes[18] and unobservable shocks ϵ_{1t}, the system includes a wage equation. The latter is based on Equation (16) in which the determinants of θ are substituted from (18). Log-linearization leads to the following long-run basic specification for the average real net wage rate:

$$ln(w) = b_0 + b_1 ln(y) + b_2 ln(\phi) + b_3 ln(\gamma) + b_4 ln(\pi) + b_5 ln(b) + b_6 ln(\beta) + b_7 ln(1+\tau) \qquad (21)$$

[18] See the end of the previous section.

or, using the notations introduced in the previous section,

$$\begin{aligned} ln(w) &= b_0 + \mathbf{b_1 ln(y)} + b_2 ln(\frac{U^{<3m}}{ET}) + b_3 ln(\frac{T}{U}) + b_4 ln(\frac{EXC}{U}) + b_5 ln(b) \\ &+ b_6 ln(\frac{\text{strikes}}{L}) + b_7 ln(1+\tau). \end{aligned} \quad (22)$$

From the theoretical analysis, we expect that b_1, b_3, b_5 and b_6 are positive and that b_4 and b_7 are negative. The sign of b_2 is however a priori ambiguous. Equation (22) is also extended to deal with compositional changes and unobservable shocks ϵ_{2t}.[19]

In the system of equations, we also include relationships that link the numerator of γ, π and ρ_u, namely T, EXC and b, to the level of unemployment and, where relevant to wages and to dummies capturing known institutional changes. These equations will be detailed when the results are presented. Finally, a set of identities close the model.The first identity equates the total number of wage earners and salaried employees, ET_t, to firms' employment, E_t, plus an exogenous number of workers employed in the public sector. Second, the exogenous size of the labor force is equated to its components. Finally, we add that the inflow into insured unemployment is an exogenous share of salaried employment: $U_t^{<3m} \equiv \phi_t ET_t$.

In sum, we have a model with five equations, three identities and eight endogenous variables : $E_t, ET_t, EXC_t, T_t, b_t, w_t, U_t, U_t^{<3m}$.

4.2 The results

It is well known that the choice of the correct statistical inference methodology is highly dependent on the time series properties of the data. In particular, the question as to whether the series are stationary is very important. When there are structural breaks, the various Dickey-Fuller and Phillips-Perron test statistics are biased towards the nonrejection of a unit root. The methodology of unit-root tests with structural breaks has been applied to the variables appearing in the system (see Perron and Vogelsang, 1992). For each variable, we conclude that the unit root hypothesis is rejected in favor of stationarity around a segmented trend.[20] Therefore standard econometric inference applies.

[19] This equation does not include the endogenous unemployment rate among the regressors because the latter is a function of the determinants of θ (see (5)). So, as soon as the determinants of θ are substituted in (16), adding the unemployment rate to the regressors can hardly be justified on the basis of our theoretical model. Furthermore, automatic indexation of wages on the CPI explains why a *real* wage equation is estimated.

[20] Detailed results are available upon request.

Table 2 presents the parameters of equations (20) and (22) resulting from a FIML estimation of the whole system made of the structural equations and the identities described above. Table 2 compares the results when LMPs are assumed to be exogenous to those when they are endogenous. Various specifications were used for the three equations modeling the process of the LMPs. The signs of the parameters of interest are fairly robust to the specification used. The estimated equations are (t-statistics between parentheses):

$$\begin{aligned} ln\,(EXC_t) &= \underset{(5.784)}{2.453} + \underset{(11.658)}{0.642} \ln(EXC_{t-1}) + \underset{(3.495)}{0.101} \ln(U_t) - \underset{(-4.329)}{0.352} \text{ Dummy}(85)_t \\ &+ \underset{(5.575)}{0.292} \text{ Dummy}(91)_t + \underset{(7.805)}{0.434} \text{ Dummy}(93)_t + \underset{(1.957)}{0.160} \text{ Dummy}(96)_t + \epsilon_{3t}, \end{aligned} \tag{23}$$

$$\begin{aligned} \Delta ln\,(T_t) &= \underset{(-1.357)}{-0.427} + \underset{(6.005)}{0.718} \ln(U_t) - \underset{(-5.739)}{0.676} \ln(U_{t-1}) - \underset{(3.321)}{0.296} \text{ Dummy}(71)_t \\ &- \underset{(6.090)}{0.533} \text{ Dummy}(78)_t + \epsilon_{4t}, \end{aligned} \tag{24}$$

$$\Delta ln\,(b_t) = \underset{(-5.859)}{-0.701} + \underset{(5.345)}{+0.266} \ln(w_t) - \underset{(-6.554)}{0.065} \ln\left(\frac{U_{t-1}}{L_{t-1}}\right) + \underset{(6.337)}{0.168} \text{ Dummy}(72)_t + \epsilon_{5t}, \tag{25}$$

where $\Delta x_t \equiv x_t - x_{t-1}$ and Dummy(s)_t is equal to 0 $\forall t \neq s$ and equal to 1 if $t = s$. Misspecification tests for equations (20) and (22) are displayed in Table 2. The same tests were successfully applied to equations (23), (24) and (25) and are available upon request.

The following long-run relationships can be derived from Table 2[21]:

$$\begin{aligned} ln(\frac{E_t}{L_t}) &= -2.17 + 0.76\Delta \ln(\frac{GDP_t}{Et_t}) + 0.42 \ln(BCI_{1t}) - 0.11 ln(\frac{U_t^{<3m}}{ET_t}) + 0.10 ln(\frac{T_t}{U_t}) \\ &- 0.13 ln(\frac{EXC_t}{U_t}) - 0.29 ln(\frac{b_t}{w_t}) + 0.03 ln(\frac{\text{strikes}_t}{L_t}) \end{aligned} \tag{26}$$

$$\begin{aligned} ln(w_t) &= 8.48 + 1.03 \ln(\frac{GDP_t}{Et_t}) - 0.09 ln(\frac{U_t^{<3m}}{ET_t}) - 0.03 ln(\frac{T_t}{U_t}) - 0.02 ln(\frac{EXC_t}{U_t}) + 0.10 ln(b_t) \\ &+ 0.01 ln(\frac{\text{strikes}_t}{L_t}) - 0.39 ln(1 + \tau_t). \end{aligned} \tag{27}$$

Before the parameters of the LMPs are commented, let us briefly consider the other ones. As expected, the rate of job separations ϕ, measured by $\frac{U_t^{<3m}}{ET_t}$, has a negative effect

[21] Equalities (26) and (27) are based on the estimates obtained when the LMPs are endogenous. In the wage equation, the effect of the business cycle indicator BCI_2 is put equal to zero since BCI_2 is the difference between two business cycle indicators that have no reason to diverge in the long run.

on the employment rate and the proxies for y influence positively the employment and net wage rates. The proxy for the bargaining power, namely the rate of strikes, has a small positive effect on the net wage but not a negative one on the employment rate. The latter impact is instead small but positive. This could be due to the quite large share of strikes (between 30 and 40%) that do not intend to sustain wage increases but well employment (typically in reaction to the announcement of collective dismissals). The average tax rate τ has a the expected negative impact on net wages.[22]

Let us now focus on the impacts of LMPs and more specifically on their long-run effects. The replacement ratio has a negative effect on the employment rate and the level of unemployment benefits is positively related to the average net wage. These results are in line with the theoretical setting. The estimated long-run elasticities are however not large. So, only large changes in the replacement ratio would have sizable effects on the employment rate.

In the theoretical model, increasing the rate of sanctions deteriorates the position of the jobless workers. This has a negative effect on equilibrium wages and a positive one on θ. The estimated effect on wages has a different sign according to the assumption made about the exogeneity of sanctions. Looking at Figure 4 and at Equation (23), we feel confident that sanctions cannot be taken as exogenous. Then, the impact on the wage rate is indeed negative. Yet, it is very small. Moreover, the estimated elasticity of the employment rate with respect to the sanction rate is negative. This outcome could hardly be explained if c_x was higher than c_u. So, the estimated results confirm our initial assumption. Eligibility criteria for unemployment benefits are more and more investigated by economists (see OECD, 2000). However, not much is known yet about the impacts of sanctions on unemployment. We are not aware of earlier papers that estimate the macroeconomic effect of sanctions on the employment rate.[23]

The theoretical model of Section 2 emphasized that training programs improve the intertemporal utility of those currently unemployed and so have a positive effect on net

[22] The elasticity is however far below 1 in absolute value. This could motivate the introduction of τ in the employment equation. Doing so, unreported estimation results indicate that the parameters of interest are not affected.

[23] Microeconomic evidence on the effect of sanctions on the hiring rate is still rather mixed. Abbring, van den Berg and van Ours (1999) find a very strong effect of sanctions on individual transitions from unemployment to employment in the Netherlands. Ashenfelter, Ashmore and Deschênes (1999) find the opposite in the U.S. The former paper uses administrative data and deals with selectivity issues while the latter is based on a randomized experiment.

wages and a negative one on θ. For this reason, their theoretical effect on the employment rate had an ambiguous sign if $c_r \geq c_u > c_x > 0$. Our empirical results suggest a small but negative effect on wages and a positive one on the employment rate. Our conclusion relative to wages is in accordance with the recent empirical analysis of Forslund and Kolm (2000) for Sweden. For Belgium, Cockx and Bardoulat (1999) develop a microeconometric evaluation of the training schemes considered in our paper. They find a favorable effect on the hiring rates of participants. It is therefore plausible that these training schemes provide various skills that improve the chances of being hired. However, training schemes for the unemployed are not meant to be an alternative to formal education. Moreover, as far as we know, the negotiated wage structures (at the sectoral or firm levels) do not explicitly recognize the certificates delivered by the training agencies. So, in a country where long-term unemployment is a major problem, it is plausible that training programmes improve the 'employability' of job-seekers *and* exert a downward pressure on wages.

5 Conclusion

This paper has developed an econometric analysis based on an extension of the equilibrium search model of Pissarides. We have tried to bridge the gap between a theoretical and an empirical literature about the macroeconomic effect of passive and active labor market policies (LMPs) on (un)employment. The empirical literature only provides an estimation of the parameters of interest conditional on the vacancy (or the unemployment-vacancy) level. Yet, the main message of the recent theoretical literature is that labor market policies presumably have an influence on wages and therefore on the number of vacant jobs. Moreover, in many countries, the reliability of the vacancies registered by Employment Agencies is rather dubious.

To face the challenge of a better integration of theoretical and empirical analyses, we have first developed a theoretical equilibrium search model of the labor market highlighting the role played by both passive and active LMPs. In this model, the ratio between vacancies and the number of job searchers (tightness on the labor market) is endogenously determined by a set of structural and LMP parameters. (The observable proxies for) these parameters have then been used to specify and estimate a model that focuses on the firms' (or 'regular') employment rate and on wage formation. The empirical analysis has taken care of the plausible feed-back effect of unemployment on the level of LMPs.

Our estimated results provide evidence that unemployment benefits have a positive, yet small, impact on wages and a negative one on the employment rate. The rate of sanctions has a small negative effect on wages. Their impact on the employment rate is however negative. This can be understood if the efficiency of the sanctioned in the matching process is sufficiently lower than the one of the insured unemployed. Training programmes have a small negative effect on wages and a small positive one on employment. The low magnitude of all these effects suggests that LMPs can only contribute to a limited extent to the rise in the employment rate to which European countries have committed during the European council of Lisbon in March 2000. Our analysis also shows that the results can be sensitive to the assumption made about the exogeneity LMPs.

Appendix 1

Recall our assumptions: $c_r \geq c_u > c_x > 0$, $1 > \rho_r \geq \rho_u \geq \sigma \geq 0$ and $\lambda \geq \phi$.

Proof of Proposition 1

From Equation 4, it can be checked that:

$$\frac{\partial e}{\partial \gamma} = \frac{\phi c_x \alpha^2 (c_r \alpha + \lambda)}{\Delta^2} \left[c_x \alpha (c_r - c_u) + \pi (c_r - c_x) \right] \begin{array}{ll} > 0 & \text{if } c_r \geq c_u \text{ and } c_r > c_x \\ < 0 & \text{if } c_r < c_u \text{ and } c_r < c_x \end{array}$$

$$\frac{\partial e}{\partial \lambda} = \frac{\phi \gamma c_x \alpha^2}{\Delta^2} \left[c_x \alpha (c_u - c_r) + \pi (c_x - c_r) \right] \begin{array}{ll} < 0 & \text{if } c_r \geq c_u \text{ and } c_r > c_x \\ > 0 & \text{if } c_r < c_u \text{ and } c_r < c_x \end{array}$$

$$\frac{\partial e}{\partial \pi} = \frac{\phi c_x \alpha^2 (c_r \alpha + \lambda)}{\Delta^2} \left[(c_r \alpha + \lambda)(c_x - c_u) + \gamma (c_x - c_r) \right] \begin{array}{ll} < 0 & \text{if } c_u > c_x \text{ and } c_r > c_x \\ > 0 & \text{if } c_u < c_x \text{ and } c_r < c_x \end{array}$$

$$\frac{\partial e}{\partial c_u} = \frac{\phi (c_r \alpha + \lambda) c_x \alpha^2}{\Delta^2} \left[(c_r \alpha + \lambda)(c_x \alpha + \pi) + c_x \alpha \gamma \right] > 0$$

$$\frac{\partial e}{\partial c_r} = \frac{c_x \alpha^2 \phi \gamma}{\Delta^2} \left[c_x \alpha (c_u \alpha + \pi + \gamma + \lambda) + \pi \lambda \alpha \right] > 0$$

$$\frac{\partial e}{\partial c_x} = \frac{\pi \phi (c_r \alpha + \lambda) \alpha}{\Delta^2} \left[(c_u \alpha + \pi)(c_r \alpha + \lambda) + \gamma c_r \alpha \right] > 0$$

The negative sign of $\frac{\partial e}{\partial \phi}$ is obvious from Equation 4.

Proof that $\Lambda_e - \Lambda_r, \Lambda_r - \Lambda_u$ and $\Lambda_u - \Lambda_x$ are positive

To sign $\Lambda_e - \Lambda_r$, subtract (11) from (9) and rewrite this difference as follows:

$$(\delta + c_r\alpha + \lambda)(\Lambda_e - \Lambda_r) = w(1 - \rho_r) + (\lambda - \phi)(\Lambda_e - \Lambda_u). \tag{28}$$

Remembering (13), it is immediately seen that $\Lambda_e - \Lambda_r > 0$.

From equations (9) to (12), it can be checked that $\Lambda_r - \Lambda_u$ is given by the following positive expression:

$$\frac{w}{D_a}\left[(\rho_r - \rho_u)(\delta + c_x\alpha) + \pi(\rho_r - \sigma) + \alpha f(\alpha, Z)\left((c_r - c_u)(\delta + c_x\alpha) + \pi(c_r - c_x)\right)\right], \tag{29}$$

with $D_a = (\delta+c_r\alpha+\lambda+\gamma)(\delta+c_x\alpha)+\pi(\delta+c_r\alpha+\lambda)$ and $f(\alpha, Z)$ is given by (13). Expression (29) would still be positive if assumption $c_r \geq c_u > c_x$ was not satisfied provided that $\rho_r - \rho_u$ and/or $\rho_r - \sigma$ were sufficiently positive. A similar remark applies below in the case of expression (30).

From equations (9) to (12), $\Lambda_u - \Lambda_x$ is given by the following positive expression:

$$\begin{aligned}\frac{w}{D_a}\Big[&(\delta + c_x\alpha)\left((\rho_u - \sigma)(\delta + c_r\alpha + \lambda) + \gamma(\rho_r - \sigma)\right) \\ &+ \alpha f(\alpha, Z)\left((c_u - c_x)(\delta + c_r\alpha + \lambda) + \gamma(c_r - c_x)\right)\Big].\end{aligned} \tag{30}$$

Proof that $\frac{\partial f}{\partial \alpha} < 0$

Differentiating (13) with respect to α yields:

$$\begin{aligned}\frac{1}{(D_b)^2}\Big(&(c_x\alpha + \delta)^2\gamma c_r(\phi - \lambda)(1 - \rho_u) + \pi c_x(\delta + c_r\alpha + \lambda)^2[\phi(\sigma - \rho_u) - (c_u\alpha + \delta) \\ &(1 - \sigma)] + (c_x\alpha + \delta)\gamma c_r\pi(\phi - \lambda) + \pi c_x\gamma(\delta + c_r\alpha + \lambda)[\phi(\sigma - \rho_r) - (c_r\alpha + \delta) \\ &(1 - \sigma)] - \pi(\delta + c_r\alpha + \lambda)^2[(c_x\alpha + \delta)c_u + \pi c_x](1 - \sigma) - (c_x\alpha + \delta)^2\gamma \\ &[c_r[c_u\alpha + \phi + \delta + \gamma + \pi(\phi + \delta + c_x\alpha)] + c_u(\delta + c_r\alpha + \lambda)](1 - \rho_r)\Big),\end{aligned} \tag{31}$$

where D_b is the denominator of (13). Under our assumptions, expression (31) is negative.

Proof of the results in Table 1

The following partial derivatives are sufficient to prove the results in Table 1. From Equation (13), it can be checked that:

$$\frac{\partial f}{\partial \gamma} = \frac{(\delta + c_r\alpha + \lambda)(c_x\alpha + \delta)}{(D_b)^2}\Bigg[\pi((\phi + \delta + c_x\alpha)(1 - \rho_r) - (\phi + \delta + c_r\alpha)$$

$$(1 - \sigma)) + (c_x\alpha + \delta)((\phi + \delta + c_u\alpha)(1 - \rho_r) - (\phi + \delta + c_r\alpha)(1 - \rho_u))\Bigg] < 0$$

$$\frac{\partial f}{\partial \lambda} = \frac{(c_x\alpha + \delta)\gamma}{(D_b)^2}\Bigg[(c_x\alpha + \delta)((\phi + \delta + c_r\alpha)(1 - \rho_u) - (\phi + \delta + c_u\alpha)(1 - \rho_r))$$

$$+ \pi((\phi + \delta + c_r\alpha)(1 - \sigma) - (\phi + \delta + c_x\alpha)(1 - \rho_r))\Bigg] > 0$$

$$\frac{\partial f}{\partial \pi} = \frac{(c_x\alpha + \delta)(\delta + c_r\alpha + \lambda)}{(D_b)^2}\Bigg[(\delta + c_r\alpha + \lambda)[(\phi + \delta + c_u\alpha)(1 - \sigma)$$

$$- (\phi + \delta + c_x\alpha)(1 - \rho_u)] + \gamma[(\phi + \delta + c_r\alpha)(1 - \sigma) - (\phi + \delta + c_x\alpha)(1 - \rho_r)]\Bigg] > 0$$

$$\frac{\partial f}{\partial c_r} = \frac{(c_x\alpha + \delta)\gamma\alpha}{(D_b)^2}\Bigg((c_x\alpha + \delta)\Bigg[(\phi - \lambda)(1 - \rho_u) - (c_u\alpha + \phi + \delta + \gamma)(1 - \rho_r)\Bigg]$$

$$+ \pi\Bigg[(\phi - \lambda)(1 - \sigma) - (\phi + \delta + c_x\alpha)(1 - \rho_r)\Bigg]\Bigg) < 0$$

$$\frac{\partial f}{\partial c_x} = \frac{\pi\alpha(\delta + c_r\alpha + \lambda)}{(D_b)^2}\Bigg(\phi\Bigg[(\delta + c_r\alpha + \lambda)(\sigma - \rho_u) + \gamma(\sigma - \rho_r)\Bigg]$$

$$- (1 - \sigma)\Bigg[(\delta + c_r\alpha + \lambda)(\delta + c_u\alpha + \pi) + \gamma(\delta + c_r\alpha + \phi)\Bigg]\Bigg) < 0$$

$$\frac{\partial f}{\partial \delta} = \frac{1}{(D_b)^2}\Bigg((1 - \rho_u)\Bigg[(\delta + c_x\alpha)^2(\gamma(\phi - \lambda) - (c_r\alpha + \lambda + \delta)^2\Bigg]$$

$$+ \pi\phi(c_r\alpha + \lambda + \delta)\Bigg[(c_r\alpha + \lambda + \delta)(\sigma - \rho_u) + \gamma(\sigma - \rho_r)\Bigg] - (1 - \rho_r)\gamma(\delta + c_x\alpha)$$

$$\Bigg[(\delta + c_x\alpha)[(c_u + c_r)\alpha + \phi + \gamma + \lambda + 2\delta] + \pi[(c_r + c_x)\alpha + \phi + \lambda + 2\delta]\Bigg]$$

$$- (1 - \sigma)\pi(\delta + c_r\alpha + \lambda)\Bigg[(\delta + c_r\alpha + \lambda)[(c_u + c_x)\alpha + \pi + 2\delta] + \gamma(c_r\alpha + \delta)\Bigg]\Bigg) < 0$$

$\frac{\partial f}{\partial \rho_r}, \frac{\partial f}{\partial \rho_u}, \frac{\partial f}{\partial \sigma}, \frac{\partial f}{\partial c_u}, \frac{\partial f}{\partial \phi} < 0$ is obvious from (13). The other properties in Table 1 are easily derived from (8) and (17).

Appendix 2 : Data

Regular employment. Number of workers occupied in firms on the 30th of June (wage earners and salaried employees, excluding the public sector). Source : Bureau Fédéral du Plan. The other employment and active population indicators used in this paper also measures workers at the end of June (Source : Ministère de l'Emploi et du Travail).
The rate of job termination. The numerator is the number of full-time insured unemployed for less than three months in June (data source : Office National de l'Emploi). The denominator measures the number of salaried workers in June (data source : Ministère de l'Emploi et du Travail).
Training programs. The numerator of T is the annual number of unemployed trainees who end a training program (data source : Office National de l'Emploi, Office Communautaire et Régional de la formation Professionelle et de l'Emploi and Vlaamse Dienst voor Arbeidsbemiddeling en Beroepsopleiding). This indicator includes training schemes organized by these public employment services or by other institutions or firms provided that they are registered by the public employment services. The denominator of T is the stock of unemployed (entitled to unemployment benefits) measured at the end of June.
The rate of sanctions π. The numerator measures the annual total flow of full-time insured unemployed who are no more entitled to unemployment benefits (data source : Office National de l'Emploi). The series of disqualifying reasons include voluntary separation from work, unavailability for a job or an active labor market policy, refusal of a suitable job offer, misconduct during unemployment (e.g. undeclared paid work), non compliance with the administrative rules and unemployment for an 'excessive' duration. The denominator is the stock of unemployed (entitled to unemployment benefits) measured at the end of June.
The replacement ratio ρ. The replacement ratio measures the ratio between the average unemployment benefit and the average net wage (both measured per head). It should be emphasized that the numerator measures the actual average benefit paid out (during the civil year). This indicator averages the benefits paid to the full-time unemployed, to the part-time unemployed (who hold a part-time job and qualify for unemployment benefits) and to several categories who were previously unemployed, are presently out-of-the-labor force and receive nevertheless an allowance (data source : Office National de l'Emploi and Bureau Fédéral du Plan). No better long time series is available in Belgium. The average net wage and tax rate (including payroll taxes) are estimated by Fatemeh Shadman-Mehta until 1994 (IRES, Université catholique de Louvain). We thank her for these data. We have extended the data for the recent years. Both the numerator and the denominator have been deflated by the CPI.
The share of women in firms' employment sharew. Number of female workers occupied in firms on the 30th of June divided by total firms' employment. Source : Bureau Fédéral du Plan.
The share of the secondary sector in total value added shares. We take the share of the secondary sector (including the building industry) in total value added. Source : Institut National de Statistique and Bureau Fédéral du Plan.
Business cycle indicators . These are an average of the monthly values of these indicators over the period July of year $t-1$ and June of year t. Source : our own computations based on the business cycle indicators of the Belgian National Bank and the private bank KBC.
Frequency of strikes . Number of strikes and lockouts (Source : I.L.O.) divided by the size of the labour force.

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parameter	$e(\theta)$*	wage curve*	vacancy supply*	equilibrium θ**	equilibrium e**
γ	+ $^{\circ}$	+ $^{\circ\ \circ}$	0	-	? $^{\circ\ \circ\ \circ}$
λ	- †	- ††	0	+	? †††
π	- ‡	- ‡‡	0	+	? ‡‡‡
$\rho_i, i = u, r$	0	+	0	-	-
σ	0	+	0	-	-
$c_i, i = u, r, x$	+	+	0	-	?
ϕ	-	+	-	-	-
δ	0	+	-	-	-
k	0	+	-	-	-
β	0	+	0	-	-
y	0	0	+	+	+

* '+' (respectively, '-', '0') $\equiv$ given θ, the function increases (respectively, decreases, remains unchanged) as the corresponding parameter (in column 1) increases.
** '+' (respectively, '-', '?') $\equiv$ the equilibrium value increases (respectively, decreases, moves in a direction that cannot be predicted) as the corresponding parameter (in column 1) increases.
$^{\circ}$ if $c_r < c_x$ and $c_r < c_u$, this sign is negative.
$^{\circ\ \circ}$ if $c_r < c_x$ and $c_r < c_u$, this sign could become negative if ρ_r was sufficiently close to ρ_u and σ.
$^{\circ\ \circ\ \circ}$ if $c_r < c_x$ and $c_r < c_u$ but the positive effect on the wage curve is maintained, this sign is negative.
† if $c_r < c_x$ and $c_r < c_u$, this sign is positive.
†† if $c_r < c_x$ and $c_r < c_u$, this sign could become positive if ρ_r was sufficiently close to ρ_u and σ.
††† if $c_r < c_x$ and $c_r < c_u$ but the negative effect on the wage curve is maintained, this sign is positive.
‡ if $c_r < c_x$ and $c_u < c_x$, this sign is positive.
‡‡ if $c_r < c_x$ and $c_u < c_x$, this sign could become positive if σ was sufficiently close to ρ_r and ρ_u.
‡‡‡ if $c_r < c_x$ and $c_u < c_x$ but the negative effect on the wage curve is maintained, this sign is positive.
Note: If k is proportional to y, the level of the latter does not affect θ nor e.

Table 1. Comparative statics.

	LMPs exog.	LMPs endog.		LMPs exog.	LMPs endog.
	$\ln\left(\frac{E_t}{L_t}\right)$	$\ln\left(\frac{E_t}{L_t}\right)$		$ln\,(w_t)$	$ln\,(w_t)$
constant	-0.217	-0.454	constant	4.317	4.611
	(-1.414)	(-3.618)		(-5.419)	(9.747)
$\ln\left(\frac{E_{t-1}}{L_{t-1}}\right)$	0.804	0.791	$ln\,(w_{t-1})$	0.541	0.456
	(15.093)	(16.077)		(7.650)	(10.578)
$\Delta\ln(\frac{GDP_t}{Et_t})$	0.161	0.158	$\ln(\frac{GDP_t}{Et_t})$	0.810	0.930
	(2.442)	(2.743)		(7.182)	(13.347)
			$\ln(\frac{GDP_{t-1}}{Et_{t-1}})$	-0.309	-0.367
				(-2.523)	(-4.871)
$\ln(BCI_{1t})^{\dagger}$	0.040	0.088	$\ln(BCI_{2t})^{\dagger\dagger}$	0.173	0.229
	(1.274)	(3.446)		(4.961)	(9.245)
$\ln\left(\frac{U_t^{<3m}}{E_t}\right)$	-0.022	-0.023	$\ln\left(\frac{U_t^{<3m}}{E_t}\right)$	-0.021	-0.051
	(-5.156)	(-6.265)		(-2.982)	(-11.495)
$\ln\left(\frac{T_{t-1}}{U_{t-1}}\right)$	0.020	0.020	$\ln\left(\frac{T_{t-1}}{U_{t-1}}\right)$	-0.008	-0.017
	(6.742)	(7.721)		(-1.487)	(-4.303)
$\ln\left(\frac{EXC_t}{U_t}\right)$	-0.020	-0.036	$\ln\left(\frac{EXC_t}{U_t}\right)$	0.015	-0.027
	(-3.519)	(-7.150)		(2.042)	(-4.065)
$\ln\left(\frac{EXC_{t-1}}{U_{t-1}}\right)$	-0.005	0.008	$\ln\left(\frac{EXC_{t-1}}{U_{t-1}}\right)$	-0.008	0.015
	(-1.003)	(1.761)		(-1.028)	(2.053)
$\ln\left(\frac{b_t}{w_t}\right)$	-0.068	-0.136	$\ln(b_t)$	0.119	0.196
	(-3.246)	(-7.015)		(4.330)	(10.318)
$\ln\left(\frac{b_{t-1}}{w_{t-1}}\right)$	0.024	0.076	$\ln(b_{t-1})$	-0.068	-0.144
	(1.251)	(4.300)		(-2.624)	(-7.601)
$\ln\left(\frac{strikes_t}{L_t}\right)$	0.005	0.006	$\ln\left(\frac{strikes_t}{L_t}\right)$	0.004	0.005
	(3.606)	(5.636)		(1.916)	(3.824)
			$\ln(1+\tau_t)$	-0.346	-0.213
				(-2.504)	(-2.624)
$\ln(shares)$	0.157	0.165	$\ln(shares)$	0.173	0.170
	(5.015)	(6.041)		(3.362)	(4.942)
			$\Delta\ln(sharew)$	-0.659	-0.702
				(-4.345)	(-8.189)
Q-stat. 1	0.894 [0.344]	0.042 [0.837]		0.010 [0.919]	3.777 [0.052]
Q-stat. 2	4.280 [0.118]	1.289 [0.525]		9.329 [0.009]	3.859 [0.145]
JB norm. test	3.182 [0.204]	0.301[0.860]		3.698 [0.157]	5.433 [0.066]

Table 2. FIML estimation of the model (Sample period: 1962-1999; t-statistics between parentheses; p-values between brackets)

After the devaluation of 1982 and during a short period in the nineties, the government introduced wage controls. These are captured by dummies in the wage equation that are not displayed in the table. 'Q-stat. 1' and 'Q-stat. 2' are Ljung-Box Portmanteau tests of residual autocorrelation up to the second order.JB is the Jarque-Bera normality test.

(†) Business cycle indicator of the KBC; (††) The difference between the two business cycle indicators.

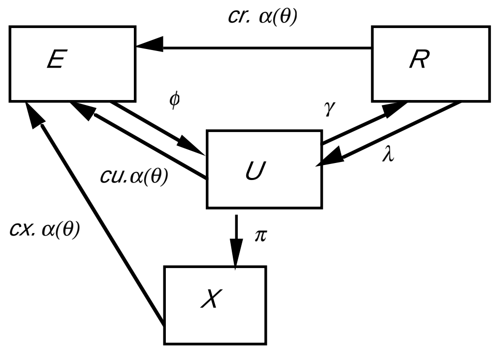

Figure 1: Labor market flows.

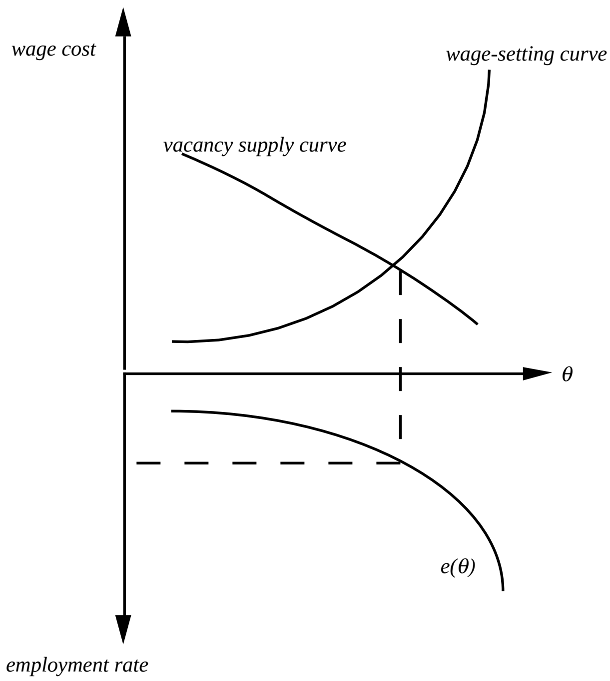

Figure 2: The steady-state equilibrium.

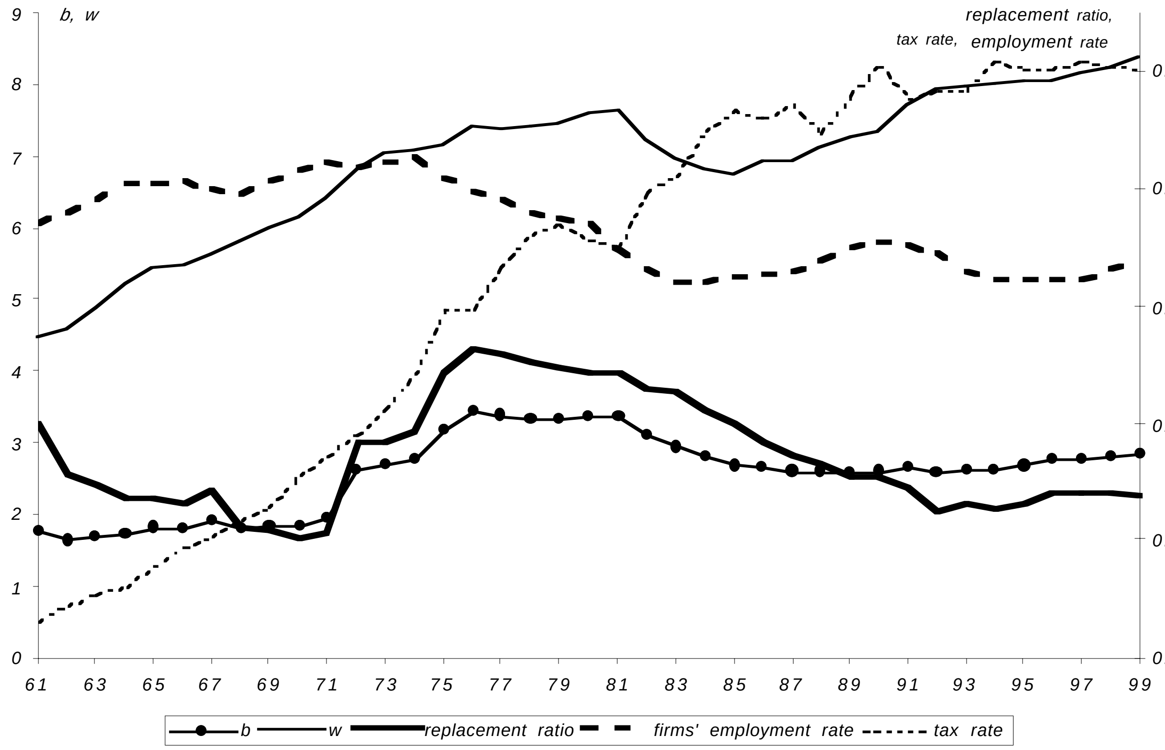

Figure 3: The firms' employment rate, $\frac{E_t}{L_t}$, the average real paid out unemployment benefit, b_t, the average real net wage rate, w_t, the average tax rate τ_t and the replacement ratio ρ_u.

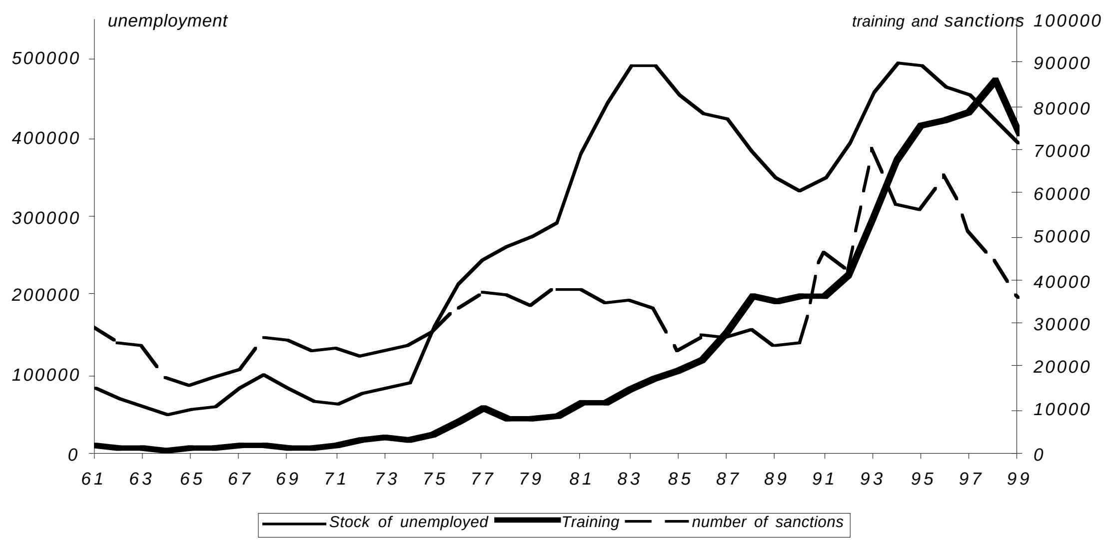

Figure 4: The numbers of sanctions EXC and of trainees ending a program T and the stock of able-bodied unemployed.

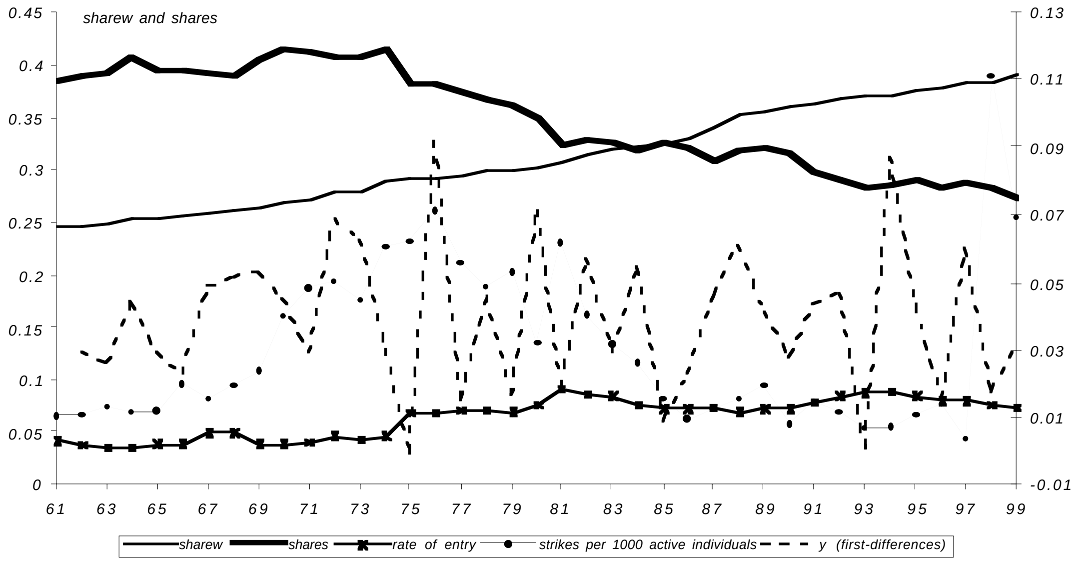

Figure 5: The share of the secondary sector in value added (*shares*), the share of women in firms' employment (*sharew*), the rate of entry into unemployment ϕ, the rate of strikes per thousand of active individuals and GDP per head as a proxy for y (first-differences in logs).