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Taxation and Labour Market Performance: A New-Keynesian Approach

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Abstract

The paper investigates the possibility of achieving more private sector employment through changes in the tax system without worsening the budgetary situation of the government. This restriction is highly relevant for countries willing to join the EMU or facing small budgetary manoeuvrability.

In order to analyse the effect of taxation on the labour market, a macro-economic model is specified with output demand, employment, prices, wages and a budget constraint. Inspired by the New-Keynesian approach, the model takes into account the imperfect situation on both the labour and the goods market. By adding a budget constraint to the model, the impact of budget-neutral tax shifts on employment can be evaluated. The model is empirically tested on Belgian data.

The policy instruments that appear in the wage equation, viz. tax rates and unemployment benefits, have an important impact on wage formation. Wage costs, including employers' contributions to social security, have a significant effect on employment. Through simulation, we conclude that there is in fact room for a revitalising employment policy without worsening the budgetary situation of the Belgian government. A decrease by 20% of the employers' contributions to social security, compensated by higher indirect taxes (10%) has favourable effects on private employment (0.5% increase after one year up to 0.8% after ten years) without causing deficit problems to the government. Other tax shifts are less favourable.

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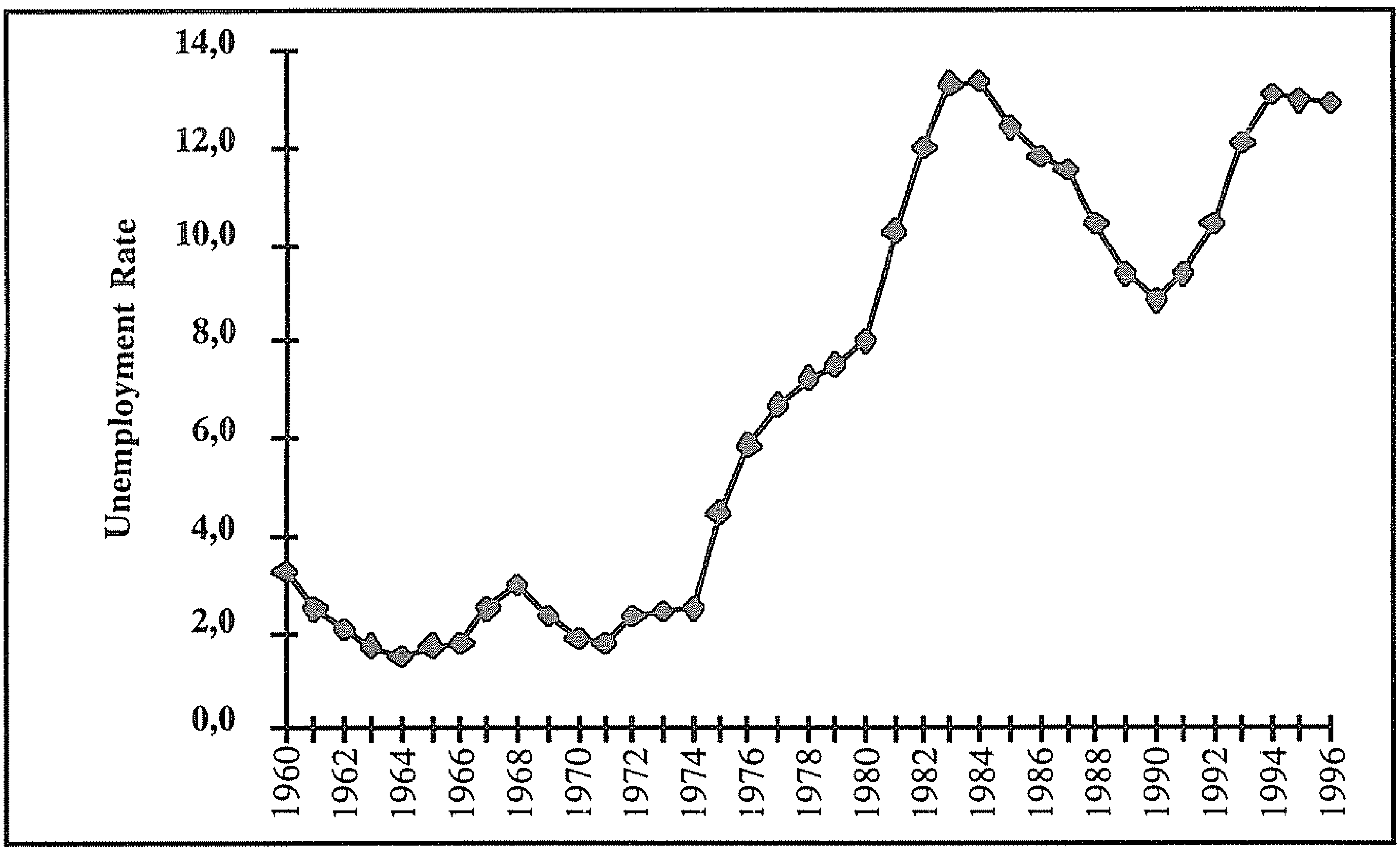
1. Introduction

As many other European countries Belgium suffers from high and persistent unemployment. The current situation on the labour market is presented in figure 1. With an unemployment rate of about 12% of the active population, inactivity is again at record levels.

FIGURE 1

Unemployment rate in Belgium 1960-1996



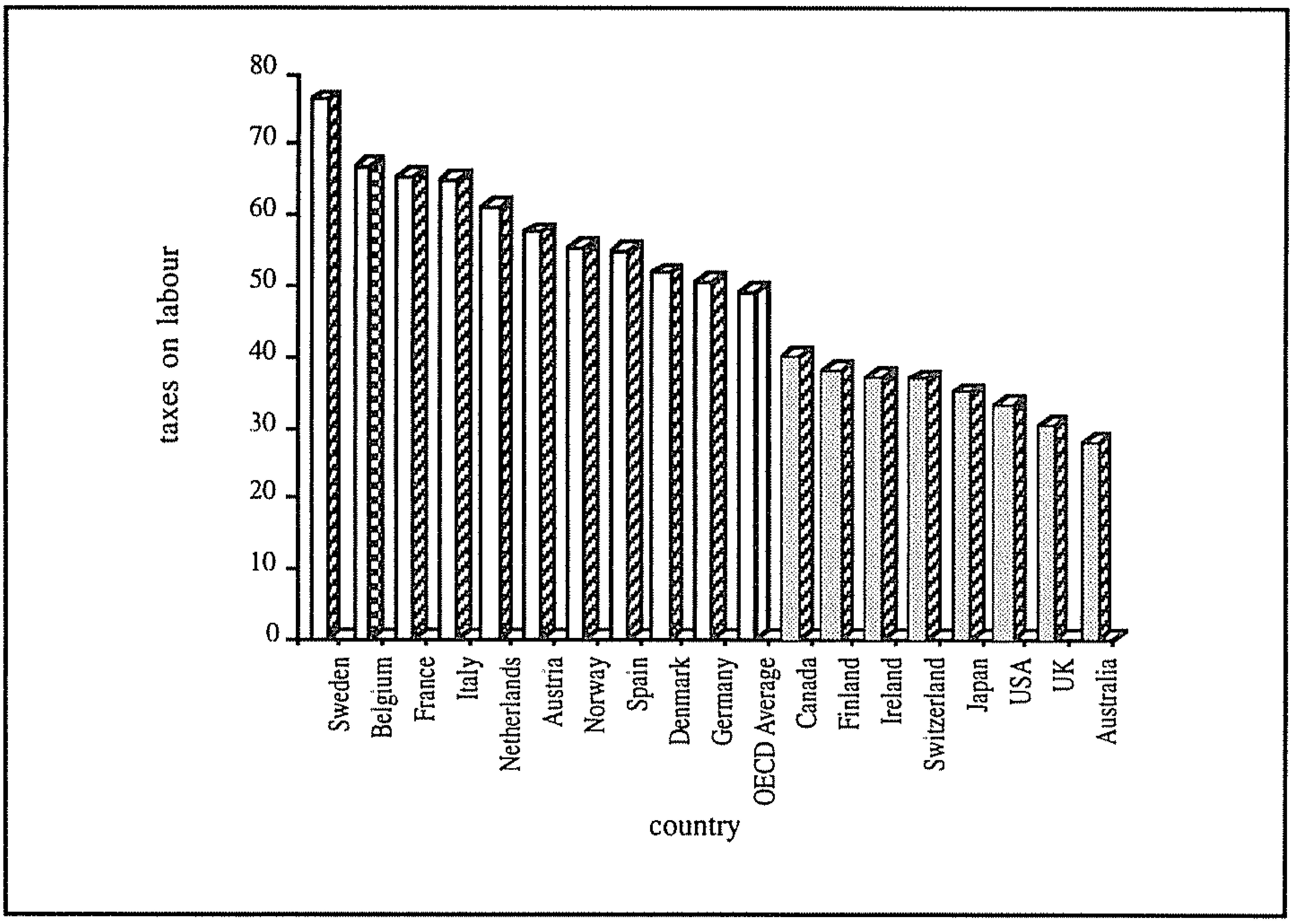
Source: OECD, 1996

It is obvious that taxes on labour explain some but not all of the labour market problems experienced by western European nations; but in the discussion on rising unemployment, taxes on labour are often singled out to be one of the causes (see e.g. Bean, 1994 and more specifically for Belgium: Federaal Planbureau, 1997). It is argued that lowering taxes would make labour more attractive, thereby reducing unemployment. In the past 20 years, taxes on labour in Belgium were indeed substantially above average in the OECD area (figure 2 shows the tax rates on labour in 1991).

Yet, the difficult budgetary situation and the constraints on public debt and deficits, implied by the Maastricht criteria, leave no room for an expansive fiscal policy. Therefore, measures are needed to improve the efficiency of the labour market without causing adverse effects on the government budget balance. This means that any tax reduction should be compensated by additional tax revenues or decreased government expenditures. It can be expected at the outset that changes in the mix of taxes by which the government raises revenues can only have a limited effect on employment (for an overview, see OECD, 1995).

FIGURE 2

Total tax rate on labour in 18 OECD-countries in 1991



Source: Heylen, 1994.

This paper investigates the scope for tax shifts that may improve the situation on the Belgian labour market without worsening the fiscal balance. In section 2 we present a macroeconomic model inspired by the New-Keynesian approach (Carlin and Soskice, 1990; Layard, Nickell and Jackman, 1991). It consists of five equations, i. e. a demand equation, an employment equation, two price equations and a wage equation, completed with a government budget constraint.

The empirical specification of the model and the estimation results are presented in section 3. Section 4 reports the results of various policy simulations that aim at reducing the tax burden on labour within the restriction of budget neutrality. The main conclusions are summarised in section 5.

2. A theoretical model of the Belgian labour market

This section presents the bare bones of the theoretical model. The structure of the model is inspired by De Bruyne and Van Rompuy (1991) and by Van Poeck and Van Gompel (1990), including four equations and a budget constraint. A New-Keynesian approach is used by which imperfect competition in the labour and the goods market is taken into account.

The first equation models the demand side which determines the output of the price-setting firm. Income variables are the most important explanatory variables of the demand for goods. Labour demand (second equation) is derived from a three-factor production function with labour, imported intermediate goods (materials and energy) and capital. The latter is considered as exogenous. Gross wages are the outcome of a Nash bargaining process, output prices are derived as a mark-up over marginal costs and consumer prices are a weighted average of output prices and import prices. Finally, the budget constraint includes the government receipts and expenditures appearing in the model. We now discuss the various equations in somewhat more detail.

2.1. Output demand

Since Belgium is a small and open economy, the demand for output is assumed to be a function of the real exchange rate (the ratio of foreign prices to domestic prices times the nominal exchange rate) and a set of income variables (X). The latter include real disposable income of households and foreign income. Output is produced to equalise demand:

$$Y_d = \left[ER \frac{Pf}{Py} \right]^{\varepsilon} g(X) \qquad (1)$$

$$Y = Y_d \qquad (2)$$

with Y, output (value added); Y_d, demand for output; Py, output price; Pf, foreign price level; ER, nominal exchange rate (BEF per foreign currency unit); X, set of income factors that influence demand; ε, price elasticity of demand (absolute value). In the sequel, the price elasticity of demand will be treated as a variable reflecting the effect of the business cycle and changes in prices of foreign competitors.

2.2. Employment

The demand for labour is derived from a general Cobb-Douglas production function in which output (Y) depends on labour (L), imported intermediate goods, i.e. materials and energy (E) and an exogenous capital stock (K):

$$Y = \alpha_0 L^{\alpha_1} E^{\alpha_2} K^{\alpha_3} \qquad (3)$$

$$0<\alpha_i<1$$

The firm's nominal profit (Π) is defined as revenue minus input costs. The latter depend on the gross wage per employee (W), the employers' contribution rate to social security (t_p), the price of imported materials and energy (Pe) and fixed costs (FC):

$$(\Pi) = PyY - W(1+t_p)\,L - PeE - FC \qquad (4)$$

Maximisation of the profit function with respect to employment (L) and imported intermediate goods (E) yields the two first order conditions. Manipulation of these two first order conditions leads to the following loglinearised labour demand function:

$$\ln L = A\left[\ln\frac{W(1+t_p)}{Py} + \left(\frac{\alpha_3}{\alpha_2-1}\right)\ln K + \left(\frac{-\alpha_2}{\alpha_2-1}\right)\ln\left(\frac{Pe}{Py}\right) + \left(\frac{1}{\alpha_2-1}\right)\ln\left(1+\frac{1}{\varepsilon}\right) - \ln(\Omega)\right] \qquad (5)$$

$$A = \frac{\alpha_2-1}{1-\alpha_1-\alpha_2} \qquad <0$$

$$\Omega = \alpha_0\alpha_1(\alpha_0\alpha_2)^{\frac{-\alpha_2}{\alpha_2-1}} \qquad >0$$

The parameter A is definitely negative. Thus, labour demand is a function of the following type:

$$L = L\left[\overset{-}{\frac{W(1+t_p)}{Py}}, \overset{+}{K}, \overset{-}{\left(\frac{Pe}{Py}\right)}, \overset{+}{\left(1+\frac{1}{\varepsilon}\right)}\right] \tag{6}$$

Note that labour demand depends negatively on real labour cost and the mark-up (as defined in the price equation below). Once the wage is determined as the outcome of a bargaining process between the union and the firm, the latter sets employment with respect to the given wage outcome. In other words, we assume that the firm has the *right to manage* and never diverges from its labour demand curve.

2.3. Prices

Profit maximisation implies the equality between marginal labour cost and the marginal cost of energy. Because we assume price-setting firms, profit maximisation determines an optimal output price (Py) which is a variable mark-up ($1 + m$) on the marginal labour cost (MLC). The mark-up depends on the price elasticity of demand. Like employment, prices are set once the outcome of the wage bargaining process is known.

$$Py = (1+m)MLC \tag{7}$$

with: $(1+\mathrm{m}) = \frac{\varepsilon}{\varepsilon+1}$

$$\mathrm{MLC} = \frac{W\left(1+t_p\right)}{\mathrm{MPL}}$$

$$\mathrm{MPL} = \frac{\partial Y}{\partial L} = \alpha_1 \frac{Y}{L}$$

The consumer price (Pc) is a weighted average of the domestic output price (Py) and the price of imported final goods before tax (Pm), with weight d that has to be determined empirically. Moreover, taxes on goods (t_g) are included.

$$P_c = (1+t_g)P_y^d P_m^{(1-d)} \tag{8}$$

2.4. *Wages*

We consider the case where the firm and the union bargain about the nominal gross wage, and the firm sets employment given the outcome of the bargaining process. This right-to-manage approach is described in Nickell and Andrews (1983) and in Hoel and Nymoen (1988). The wage bargain is assumed to be described as a Nash bargaining model. Thus the wage outcome satisfies:

$$\arg(W)\max\Phi = \arg(W)\max\left[(N - N_0)^z(\Pi - \Pi_0)^{1-z}\right] \quad \textbf{(9)}$$

where N is the union's utility; N_0, the union's fall-back utility level in case of no agreement; Π, the firm's profit; Π_0, the firm's fall-back profit level in case of no agreement; and z, the relative bargaining power of the union.

In the following parts, we define the union's and the firm's utility and fall-back utility level. Furthermore, we assume that in case of no agreement, production stops and that in that case the firm still incurs its fixed costs.

2.4.1. Utility level of the union

It is assumed that the union represents all members of the labour force and that the utility of the latter depends on their purchasing power. Within this model, the utility function of the representative worker is specified as follows:

$$V\left[\frac{W(1-t_w)}{Pc}\right] \quad \textbf{(10)}$$

where V is the representative worker's utility function and t_w, the employees' average tax rate on labour income (incl. social security contributions), which is assumed to be an increasing function of W.

Each member of the labour force is either employed in the private sector (receiving W), or employed in the public sector (receiving the government wage), or unemployed (receiving an unemployment benefit). Therefore, the union's utility function of a generalised utilitarian form can simply be represented as:

$$N = rV\left(\frac{W(1-t_w)}{Pc}\right) + (1-r)\left[sV\left(\frac{W_G(1-t_w)}{Pc}\right) + (1-s)V(B)\right] \quad \textbf{(11)}$$

with B, the average unemployment benefit in real terms and W_G, the gross wage per employee in the public sector. The total labour force (LF) equals the sum of employment in the private sector (L^P), public sector employment (L^G) and the total number of unemployed people. r equals total private employment divided by the total labour force. The share of total government employment in the labour force not employed in the private sector is represented by s:

$$s = \frac{L^G}{(LF - L^P)} = \frac{L^G}{(L^G + U)} \tag{12}$$

In case of no agreement, production stops and none of the private workers receive a wage. The union's fall-back utility level is then reduced to the following form:

$$N_0 = sV\left(\frac{W_G(1-t_w)}{Pc}\right) + (1-s)V(B) \tag{13}$$

If only a fraction (1-f) of the private sector workers is fired and the workers receive a strike compensation S, the fall-back utility level would equal:

$$N_0 = fV(S) + (1-f)\left[sV\left(\frac{W_G(1-t_w)}{Pc}\right) + (1-s)V(B)\right] \tag{14}$$

The only change in terms of the wage equation derived is that S becomes an argument with a positive sign. In this paper, that case is not considered. Therefore, the utility differential becomes:

$$N - N_0 = r\left[V\left(\frac{W(1-t_w)}{Pc}\right) - sV\left(\frac{W_G(1-t_w)}{Pc}\right) - (1-s)V(B)\right] \tag{15}$$

The derivative of the utility differential with respect to W is given by (16). V_0 stands for the representative worker's fall-back utility level, ε_w^L the private employment demand elasticity with respect to the private sector wage and V_W is the derivative of V with respect to $W, \left(V_W = \partial V / \partial W\right)$.

$$\frac{\partial(N - N_0)}{\partial W} = \frac{L_W^P}{LF}(V - V_0)\left(\frac{L^P}{LF}\right) + V_W = r\left[\varepsilon_W^L\left(\frac{1}{W}\right)(V - V_0) + V_W\right] \tag{16}$$

Note that through equation (16) the marginal utility of a wage increase for the employee, V_w, will appear in the final solution for the wage outcome. In view of equation (10), this implies that the employees' marginal tax rate on labour income, τ_w, enters as a variable in the wage equation, since average taxrate t_w is assumed to be an increasing function of W.

2.4.2. Utility level of the firm

The utility of the firm is assumed to equal nominal profits, which implies risk neutrality. Based on the general Cobb-Douglas production function in section 2.2. (3), the firm has the following nominal profit definition:

$$\Pi = PyY - W(1+t_p)\,L - PeE - FC \tag{17}$$

The fall-back profit level in case of no agreement with the union is derived in a similar way as before. The firm has no production and therefore no variable production costs. Because the fixed costs cannot be avoided, the fall-back profit level is represented as:

$$\Pi_0 = -FC \tag{18}$$

In consequence, the profit differential and its derivative become respectively:

$$\Pi - \Pi_0 = PyY - W(1+t_p)\,L^P - PeE \tag{19}$$

and $$\frac{\partial(\Pi - \Pi_0)}{\partial W} = -(1+t_p)\,L^P \tag{20}$$

2.4.3. Wage outcome of the Nash bargaining process

The first and second order conditions of the Nash bargaining problem are:

$$\Phi_W = z(\Pi - \Pi_0)\frac{\partial(N - N_0)}{\partial W} + (1-z)(N - N_0)\frac{\partial(\Pi - \Pi_0)}{\partial W} = 0$$

$$\Phi_{WW} < 0$$

Substituting (19), (16), (15) and (20) in (21), dividing by L^P and multiplying by (1-r)/r, one obtains:

$$z\left[\frac{(\Pi - \Pi_0)}{L^P}\right](1-r)\left[\varepsilon_W^L\left(\frac{1}{W}\right)(V - V_0) + V_W\right] +$$

$$(1-z)(1-r)\left[V\left(\frac{W(1-t_w)}{Pc}\right) - sV\left(\frac{W_G(1-t_w)}{Pc}\right) - (1-s)V(B)\right](-(1+t_p)) = 0$$

The latter equation contains an implicit solution for W* in terms of the following variables:

$$W* = W^*\left[\frac{(\Pi - \Pi_0)}{L^P}, u, \frac{Pc}{(1-t_w)}, W_G, \frac{L^G}{LF}, (1+t_p), B, (1-\tau_W)\right] \tag{23}$$

where u stands for the unemployment rate and equals U/LF or (1-r)(1-s), and L^G/LF equals s(1-r).

As mentioned above, through V_W, the marginal utility of a wage increase for an employed union member, the employees' marginal tax rate on labour income, τ_w, is introduced and appears in the form (1-τ_w). It is assumed that a higher marginal income tax rate reduces the marginal utility of a wage increase, so the derivative of V_W with respect to (1-τ_w) is positive.

2.4.4. Comparative static analysis

A comparative static analysis on the first order condition of the Nash bargaining problem allows us to determine the sign of the relevant variables in the private wage equation. The results are summarised in table 1. We now pay attention to the interpretation of these signs.

An increase in the employers' contribution rate to social security $(1+t_p)$, will be shifted backwards into a decrease of the contracted gross wage with the specific reason that these contributions reduce the firm's profit, so that the firm will concede less wage increases.

Another example, whereby the union increases its wage claims is given by an increase of the profit differential per worker, $(\Pi-\Pi_0)/L^P$. Since a rise in the consumer price-income tax wedge, $Pc/(1-t_w)$ works in the same direction, both changes will be shifted forward into higher wages. Regarding the latter, the union is concerned with the real after tax wage of the workers.

TABLE 1

Comparative statics

Change in:	Effect on nominal gross wage per employee (W):
$(1+t_p)$	(–)
$(\Pi-\Pi_0)/L^P)$	(+)
W_G	(+)
B	(+)
$(1-\tau_w)$	(+)
$Pc/(1-t_w)$	(+)
$(1-r)(1-s) = U/LF = u$	(–)
$s(1-r) = L^G/LF$	(+)

In this bargaining model, the marginal tax rate, τ_w, will have a negative influence on the wage outcome, hence $(1-\tau_w)$ will have a positive one (see also: Hersoug, 1984; Hersoug et al., 1986; Malcomson and Sartor, 1987). Notice that this result is opposite to the one that is obtained in a demand-supply equilibrium model of the labour market. In a bargaining model, a rise of the marginal income tax rate reduces the marginal utility of a wage increase for an employed union member and will therefore induce less vigorous wage claims. As a result, the trade-off between wage income and profit income will shift in favour of the latter and causes a fall in wages.

In a demand-supply equilibrium model, a rise of the marginal tax rate (at given average tax rate) causes a negative substitution effect on labour supply, which will generally have a positive influence on wages (Graafland, 1991).

The possibility of getting a job in the public sector (if not obtained in the private sector) is taken into consideration by the union in the bargaining process. A higher share of public employment, captured by L^G/LF, increases the probability, for every private dependent worker, of becoming a public employee when the higher wage claims induce the firms to lay off workers. The higher the fall back utility level of the laid-off workers, the more the union will try to obtain higher wages.

The relationship between real unemployment benefits, B, and wages is shown as positive, because the union's fall-back utility level, N_0, increases when B increases, thereby pushing up wage claims. Public employment and the benefit system thus seem to be two important instruments of government intervention in the labour market which have influence on wage formation in the private sector.

Finally, the unemployment rate in the economy, u, captures the effect of external conditions of the labour market. When u rises, more workers, potentially employable, are knocking at the firms' and union's doors, thus contributing to a moderation of wage claims and offers.

2.5. The government budget

For the purpose of the present analysis, we define the endogenous government[2] deficit, D, as the difference between the outlays for unemployment benefits and government wages and the income from various taxes considered. In this paper, we explicitly rule out alternative financing for unemployment outlays, i.e. borrowing and cuts on other expenditures. Hence, the deficit is defined as:

$$D = \left[(B_n U) + W_G L^G \right] - \left[(t_p + t_w) W^P L^P + t_w W_G L^G + t_g Y P y + t_c \Pi + t_0 I_0 \right] \quad (24)$$

In order to induce changes in the deficit and/or employment, the government commands various policy instruments: t_p, the employers' contribution rate to social security, t_w, the employees' average tax rate on labour income (incl. social security contributions); t_g, the tax rate on goods and services; t_c, the corporate tax rate; t_o, the tax rate on other income; B_n, nominal unemployment benefits;

[2] In this paper the term government refers to central government and social security.

L^G, public sector employment; and W_G, the gross wage per employee in the public sector. D is the endogenous government deficit, U the total number of unemployed and I_0, a catch-all of other income, (e.g. income of self employed, income from property).

Total public sector deficit (TD) includes our endogenous definition of the deficit and an exogenous component (D_0) which captures all other public expenditure and revenue:

$$TD = D + D_0 \tag{25}$$

With respect to the wage bargaining outcome, government policy is purely accommodating. Indeed, wages, employment, output and prices will affect the government revenue and expenditure and the public deficit. However, the latter is assumed not to influence the behaviour of the bargaining agents in the model.

3. Empirical analysis

This section presents estimations of the five equations in the model. They show that our theoretical insights fit reality fairly well. The empirical investigation is limited to employment and wages of dependent workers in the private sector in Belgium. In other words, the employment and wage formation in the government sector and of self employed workers are not explained. Our theoretical assumptions of a right-to-manage model with wage bargaining between a union and a price-setting firm are indeed not realistic for the analysis of wage formation in these parts of the labour market.

3.1. Data and definitions

The data we use in the estimation of the equations, are obtained or computed from OECD statistics (Economic Outlook {EO}, National Accounts {NA}, Revenue Statistics {RS}), IMF statistics (International Financial Statistics {IFS}), the Eurostat General Government Accounts {GGA} and Belgian statistics {RVA}. For an overview of the variables used, together with their sources we refer to the appendix.

Note that the employees' tax rate (t_w) only applies to labour income and is therefore different from total direct taxation. The trend value of real private output (Y_t) is computed as the fitted series from a regression of y (lnY) to a time trend of the fourth order, over the period 1960-1990. *RDI* (households real disposable income) includes the net private and government wage bills and a residual factor called "other income". The latter contains among other things income from property and capital and the compensation of the self employed net of taxes.

For the computation of the employees' marginal tax rate on labour income (τ_w), we estimate a tax function, similar to Hersoug, Kjaer and Rodseth (1986). However, a constant (is introduced in order to avoid a perfect positive correlation between the marginal and the average tax rate, which would prohibit using both variables in an empirical wage equation. The functional form is specified in terms of *TB* which stands for the tax bill and contributions paid by dependent workers and *WB*, the wage bill of the dependent workers.

$$TB = WB - \beta(WB - \alpha)^{(1-\gamma)} \quad \textbf{(26)}$$

A property of the macro-economic tax function (26) is that γ can be interpreted as a measure of the degree of progressivity of the tax system (γ>0). The higher is γ, the more progressive the system is. Non linear estimation, with NLS[3], of the tax function yields specific values for the parameters α, β and γ. The latter equation implies the following expressions for the respective tax rates:

$$t_w = \frac{TB}{WB} = 1 - \beta(WB - \alpha)^{-\gamma}\left(1 - \frac{\alpha}{WB}\right) \quad \textbf{(27)}$$

$$\tau_w = \frac{\partial TB}{\partial WB} = 1 - \beta(1-\gamma)\ (WB - \alpha)^{-\gamma} \quad \textbf{(28)}$$

Finally, we compute the marginal out of the average tax rate as follows:

$$(1 - \tau_w) = (1 - \gamma)(1 - t_w)\left(\frac{WB}{WB - \alpha}\right) \quad \textbf{(29)}$$

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[3] The dependent variable is defined as TB-WB, the sample range is 1965-1990, the values obtained are :
$(1-\gamma)$=0.8, α=58.3 and β=3.

3.2. Estimation results

This section presents the empirical specification of the model. Because the estimated equations approximate the theoretically derived equations very well, the explanations for the expected signs can be found in section 2 of this paper.

The empirical model consists of five estimated equations. The equations are estimated as a system, using three stage least squares, on yearly data for the period 1972-1990. All exogenous and lagged endogenous variables are used as instruments. The two price equations are estimated in growth rates, whereas the other equations are estimated in natural logarithms of levels. The expected signs of the various coefficients are given in equations (31), (34), (37), (39).

The estimation results are shown in tables 2 to 5. According to these results, the model we specified fits reality fairly well. Almost all coefficients have the right sign and most of them, particularly the ones we are concerned with, are significant at any reasonable significance level. More important, the results presented in tables 3 and 5 show that the policy instruments, tax rates and unemployment benefits, that appear in the employment and wage equations, have a significant impact on wage formation and on employment.

3.2.1. The demand equation

Demand for private sector output is specified as a function of the real exchange rate and a set of domestic and foreign income factors (see 2.1.). Empirically, our demand equation looks as follows:

$$y = c_{10} + c_{11}re + c_{12}rdi + c_{13}fi \qquad (30)$$

$$\text{with: } re = \ln\left(ER\frac{Pf}{Py}\right) \quad c_{11} > 0$$

$$rdi = \ln(RDI) \quad c_{12} > 0 \qquad (31)$$

$$fi = \ln(FI) \quad c_{13} > 0$$

The real exchange rate captures the competitive position of the economy and its coefficient is expected to have a positive sign. Households' real disposable income is included to reflect the demand side effects of taxation. We also specify a dummy in the demand equation, taking the value 1 in 1981, because in that year the Belgian government launched a series of fiscal policy measures aiming at, among other things, the reduction of labour costs.

As shown in table 2 the income variables (*rdi, fi*) and the competitive position, measured by the real exchange rate (*re*), have the correct sign and are highly significant. These results show that taxation has an undeniable impact on the demand side of the economy.

TABLE 2

Estimation of the demand equation

dependent variable: *y*	coefficient	t-statistic
cte	–2.88	(–13.99)
re	0.10	(8.92)
rdi	0.64	(14.16)
fi	0.56	(23.31)
DUM81	–0.04	(–5.64)
DW=1.98	$R^2_c = 0.99$	S.E.R. = 0.007

3.2.2. The employment equation

For the empirical part we allow employment to differ from its optimal level in equation (6). Therefore we introduce adjustment costs: actual employment (L) in any period may differ from its optimal level (L^*).Thus:

$$\ln L = \lambda(\ln L^*) + (1-\lambda)(\ln L_{-1}) + \eta \quad (32)$$

However, this simple adjustment process could not capture the slow response of firms to the first oil shock. This adverse supply shock was apparently perceived as a temporary one. Therefore, a dummy was introduced in the employment equation, taking the value 1 in 1974. We estimate the following (private sector) employment equation[4]:

$$l = c_{21} + c_{22}wp + c_{23}pepy + c_{24}re_{-1} + c_{25}yyt + c_{26}l_{-1} + c_{27}k \qquad \mathbf{(33)}$$

with,

$$\begin{aligned} l &= \ln\left(L^P\right) & c_{26} &> 0 \\ wp &= \ln\left(\frac{W\left(1+t_p\right)}{Py}\right) & c_{22} &< 0 \\ pepy &= \ln\left(\frac{Pe}{Py}\right) & c_{23} &< 0 \\ re &= \ln\left(ER\frac{Pe}{Py}\right) & c_{24} &< 0 \\ yyt &= \ln\left(\frac{Y}{Y_t}\right) & c_{25}\,&? \\ k &= \ln(K) & c_{27} &> 0 \end{aligned} \qquad \mathbf{(34)}$$

One can infer from the estimation results for the employment equation (table 3) that the real wage cost (*wp*), which includes the employers' contribution rate to social security (t_p), has a significantly negative effect on employment, but its impact is rather low. A 10% increase in wage cost implies a direct decrease in employment of 0.7%. In the long run, however, the employment loss amounts to 1.8%. A low wage cost elasticity of labour demand is not unusual for macroeconomic studies (for an overview, see e.g. Hamermesh, 1993). Recent microeconomic studies however, find a much higher elasticity (for Belgium, see Konings and Roodhooft, 1995).

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4 The expected sign of *re* is opposite to its sign in the price equation. We will assume that foreign prices have a positive effect on the mark-up and therefore, ceteris paribus, a negative effect on employment. The expected sign of the business cycle variable is not clear at first sight. There is no theoretical consensus about the cyclical behaviour of the mark-up.

TABLE 3

Estimation of the employment equation

dependent variable: l	coefficient	t-statistic
cte	3.75	(8.89)
wp	–0.07	(–5.61)
pepy	–0.08	(–5.91)
re_{-1}	–0.02	(–1.83)
yyt	0.36	(5.79)
l_{-1}	0.61	(15.52)
DUM74	0.02	(4.77)
h = –0.50	$R^2_c = 0.99$	S.E.R. = 0.005

The element of foreign prices in the mark-up is only significant at the 10% level (we find the same result in the price equation, cf. infra). Higher foreign prices push up domestic prices through the mark-up and consequently lower labour demand (see also table 4).

The cyclical element (*yyt*) has a positive sign in both the employment and price equations, which indicates that the business cycle not only works through the mark-up but probably also via changes in labour productivity. An increase of labour productivity in an upswing[5] leads to more demand for labour, at a given wage. However, this kind of reasoning does not fit rigorously into our theoretical assumptions upon which the model is based. Yet, this result is in line with other recent studies of the Belgian labour market (see e.g. Heylen, 1992: 51-53 and 110-112).

[5] For explanations of a pro-cyclical movement of productivity, see Lindbeck and Snower (1988), Blanchard and Summers (1988), Okun (1981), or Andersen (1989).

3.2.3. Price equations

As stated above, the variable mark-up is supposed to be influenced by the business cycle and by the price setting behaviour of foreign competitors. If the mark-up moves cyclically and follows foreign prices, both variables will have a positive sign. As noted above, the data will reveal the cyclical behaviour of the mark-up, for there is no consensus in the literature about the expected sign of c_{25} and c_{32} in equations (34) and (37).

The cyclical factor is defined as the deviation of private output from its trend value, the lagged real exchange rate is a measure of the foreign price level and a lagged dependent variable is introduced in the output price equation (35).

$$py = c_{30}mlc + c_{31}re_{-1} + c_{32}yyt + c_{33}py_{-1} \qquad (35)$$

$$and\ pc = tg + c_{41}py + (1 - c_{41})pm \qquad (36)$$

with, $py = \ln(Py) - \ln(Py_{-1}) \qquad c_{33} > 0$

$mlc = \ln(MLC) - \ln(MLC_{-1}) \qquad c_{30} > 0$

$re = \ln\left(ER\frac{Pf}{Py}\right)_{-1} - \ln\left(ER\frac{Pf}{Py}\right)_{-2} \qquad c_{31} > 0$

$yyt = \ln\left(\frac{Y}{Y_t}\right) - \ln\left(\frac{Y}{Y_t}\right)_{-1} \qquad c_{32}\,?$

$pc = \ln(Pc) - \ln(Pc_{-1}) \qquad (37)$

$tg = \ln(1 + t_g) - \ln(1 + t_g)_{-1}$

$pm = \ln(Pm) - \ln(Pm)_{-1} \qquad 0 < c_{41} < 1$

TABLE 4

Estimation of the price equations, ln(Py) and ln(Pc)

dependent variable: *py*	coefficient	t-statistic
mlc	0.37	(3.79)
re_{-1}	0.05	(1.77)
yyt	0.32	(2.50)
py_{-1}	0.64	(5.98)
DUM76	–0.04	(–2.92)
h = –1.33	$R^2_c = 0.99$	S.E.R. = 0.014
dependent variable: *pc*	coefficient	t-statistic
tg	1.00	
py	0.85	(5.29)
pm	0.15	
DW = 1.99	$R^2_c = 0.99$	SER = 0.009

The price equations in table 4 also show a good fit (a dummy captures the effects of an extensive program of direct price controls in 1976). The mark-up is positively influenced by the level of foreign prices, although the coefficient is only significant at the 10% level. Another finding is the pro-cyclical movement of the mark-up. As mentioned earlier, the identical effect of the business cycle on price-setting and labour demand is somewhat puzzling.

3.2.4. The wage equation

Like Layard, Nickell and Jackman (1991: 203-204), we introduce a variable u_{-1} which, for its impact, depends on insider dynamics and long-term unemployment effects. We therefore estimate the following wage equation:

$$w = c_{51} + c_{52}\pi + c_{53}lu + c_{54}lu_{-1} + c_{55}pt + c_{56}lg + c_{57}tp + c_{58}b + c_{59}\tau \quad \textbf{(38)}$$

$$
\begin{array}{lll}
\text{with, } w = \ln(W) & c_{52} > 0 & \\
\pi = \ln\left[\dfrac{(\Pi - \Pi_0)}{L^P}\right] & c_{52} > 0 & \\
lu = \ln(u) & c_{53} < 0 \quad c_{54} > 0 & \\
pt = \ln\left(\dfrac{Pc}{(1-t_w)}\right) & c_{55} > 0 & \textbf{(39)} \\
lg = \ln\left(\dfrac{L^G}{LF}\right) & c_{56} > 0 & \\
tp = \ln(1+t_p) & c_{57} < 0 & \\
b = \ln(\text{B}) & c_{58} > 0 & \\
\tau = \ln(1-\tau_w) & c_{59} > 0 &
\end{array}
$$

On the basis of factual observations in Belgium, it is clear that wages in the public sector follow wages in the private sector. However, as derived in equation (23), W_G influences W. Hence, regarding the Belgian institutional settings, W_G does not make part of the set of explanatory variables in the wage equation (38).

Table 5 reports on the estimation results of the wage equation. The employees' average tax rate on labour income appears to be a very important wage push factor. The coefficient of *pt* shows that the union is able to shift forward a tax increase completely into an increase of gross wages. The sign of the coefficient on the marginal tax variable is also in line with our theoretical expectations. The impact of the employers' contribution rate to social security t_p is important. Private employers can almost completely (72%) shift backward higher contributions into a lower gross wage.

Average unemployment benefits are clearly not to be neglected as a wage push factor. A 10% increase in the average benefit B (in real terms) implies an increase of about 5.5% of the nominal gross wage per dependent worker in the private sector. However, it should be mentioned that we do not account for the distinction between the amount and the duration of the benefits, which both affect the average benefit per unemployed person.

TABLE 5

Estimation of the wage equation

dependent variable: w	coefficient	t-statistic
cte	4.07	(8.46)
π	0.21	(3.29)
lu	–0.16	(–5.31)
lu_{-1}	0.13	(7.31)
pt	1.00	(6.75)
lg	0.32	(3.56)
tp	–0.72	(–3.57)
b	0.55	(18.27)
τ	0.87	(3.68)
DW = 2.32	$R^2_c = 0.99$	S.E.R. = 0.012

Labour market policy, captured by the proportion of public employment in the economy, has an influence on the wage bargaining process. Through the fall-back utility level of the union, government employment pushes wages up. The unemployment rate has a small but significant moderating effect on wages. The coefficient on the lagged unemployment rate points to a fairly high degree of hysteresis. The significant positive effect on the wage level of the profit differential per worker bears out the idea that unions succeed in exploiting the firms' market power by claiming a part of the profits for the workers.

4. Policy simulations

The estimation results in the previous section indicate the direct impact of the various taxes on different important variables in the economy. Our concern, however, is to know the complete and ultimate effects of taxation on employment and on the budget deficit. For this purpose, we performed simulations with the entire model.

A dynamic simulation is run within the sample period (1972-1990), using historical values of all the variables in the model, through which the fitted values for the endogenous variables are obtained. Then, changes in one or more policy instrument are simulated within the same sample period. The results of the dynamic policy simulations are compared with the fitted values in order to show the shifts in the endogenous variables induced by the changes in the policy instruments. From the obtained results of various simulations, as shown below, one can conclude that there is indeed a scope for changes in the tax system that improve the labour market performance without worsening the budgetary situation.

4.1. Employment and budget effects of uncompensated and compensated reductions of the employers' contribution rate to social security

The first policy simulation concerns an uncompensated decrease in employers' contributions to social security of 20% (table 6a). Therefore, t_p is multiplied by 0.8 for the whole sample period. This means that the employers' tax rate is 4 to 5.5 percentage points lower than its historical value. Such a decrease results in an immediate employment growth of about 0.7%, which increases to more than 1.3% in the long run. As expected, this uncompensated tax reduction has an unfavourable effect on the budget deficit, which increases with 11% in the short run and 2 to 5.5% in the long run.

TABLE 6A

Uncompensated reduction of t_p

Simulation: t_p * 0.8		
After	*effect on D*	*effect on L^P*
1 year	+11.3%	+0.7%
3 years	+10.9%	+0.9%
5 years	+5.5%	+1.1%
10 years	+2.0%	+1.2%
15 years	+5.5%	+1.3%

Another simulation aims at balancing the budgetary effect by either an increase of t_g (indirect tax rate) of 10% or by a decrease of B_n (the average nominal benefit for an unemployed person). With regard to the deficit, these changes do equilibrate the budget, although in the short run the first option (t_g*1.1) is most favourable.

TABLE 6B

Compensated reduction of t_p

Simulation: t_p * 0.8 and t_g * 1.1		
After	*effect on D*	*effect on L^P*
1 year	+0.0%	+0.5%
3 years	+3.3%	+0.6%
5 years	+0.0%	+0.8%
10 years	–1.2%	+0.8%
15 years	+0.0%	+0.9%
simulation: t_p * 0.8 and B_n * 0.8		
After	*effect on D*	*effect on L^P*
1 year	+9.1%	+0.7%
3 years	+6.9%	+0.9%
5 years	+1.1%	+1.1%
10 years	–1.8%	+1.1%
15 years	+0.3%	+1.2%

4.2. Alternative policy simulations

Table 7 presents some other policy measures that are unfavourable, either with respect to employment or with respect to the government deficit.

An autonomous wage decrease of 5%, simulated by a decrease of the constant in the wage equation (c_{21} in equation (37)) of 0.05, generates a gain in employment but also a considerable augmentation of the deficit (because of the smaller tax base). Thus, the deflationary effects of a substantial wage moderation should not be overlooked.

Compensating revenue losses, caused by a decrease of t_p, through higher income taxes (t_w*1.1), creates adverse effects on employment. The unfavourable budgetary situation has disappeared, but the employment gain of lower employers' taxes is reversed in an employment loss. Shifting forward of income taxes into higher gross wages explains this result.

TABLE 7

Alternative policy simulations

Simulation: cte – 0.05 in the wage equation		
After	*effect on D*	*effect on L^P*
1 year	+19.0%	–0.1%
3 years	+19.0%	+0.0%
5 years	+19.5%	+0.1%
10 years	+14.0%	+0.3%
15 years	+21.9%	+0.7%
Simulation: t_p * 0.8 and t_w * 1.1		
After	*effect on D*	*effect on L^P*
1 year	–10.0%	–0.0%
3 years	–8.5%	–0.3%
5 years	–10.5%	–0.5%
10 years	–8.5%	–1.2%
15 years	–19.5%	–1.5%

Simulation: t_w * 0.8		
After	*effect on D*	*effect on L^P*
1 year	+38.2%	+1.4%
3 years	+38.0%	+2.2%
5 years	+33.9%	+3.0%
10 years	+24.1%	+4.2%
15 years	+45.3%	+5.0%

Finally, a reduction of employees' taxes on labour income of 20% (i.e. t_w*0.8 or t_w decreases with 4.5 to 7 points) is simulated. The idea behind this policy measure is that it will allow a wage moderation and/or an increase of the households disposable income. The figures in table 7 do indeed show the substantial employment gain, but also the huge increase (about 50%) of the government deficit. It is clear that no reasonable tax increase or revenue cut could ever compensate for this loss of government receipts.

5. Conclusions

This paper investigates the interference of taxation with the performance of the labour market. A macro-economic model is specified in section 2, including a demand equation, an employment equation, price-setting equations, a wage equation and the government budget constraint. Our global framework is the New-Keynesian approach, in which wages are the outcome of a Nash bargaining process between a price-setting firm and the union. We assume that the latter represents all members of the labour force. By including a budget constraint in the model, the impact of budget-neutral tax shifts on employment is evaluated.

The model is empirically tested on Belgian data in section 3. The estimation results point out the significant impact of policy instruments such as the tax rates and unemployment benefits on wage formation. The wage cost has a significant effect on employment. The results also show that the union is able to shift forward a tax increase on labour income completely into higher gross wages. Private firms can almost completely (72%) shift backward a rise of employers' taxes into lower gross wages.

In section 4 we simulate the macro-economic impact of various employment tax shifts. Considering the government budget constraint, the most favourable employment policy measure appears to be a reduction in the employers' contribution rate to social security compensated by lower unemployment outlays or by higher indirect taxes.

This paper points to a possible scope for budget-neutral tax shifts with a positive impact on employment within a New-Keynesian framework. The empirical results are particularly promising for governments facing a severe fiscal constraint.

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Appendix: Overview of the variables used and their sources[1]

τ_w : dependent employees' marginal tax rate on labour income {computed}

B : average unemployment benefit in real terms (francs) {RVA}

ER : nominal exchange rate BEF/$ {IFS}

FI : foreign income, real OECD GDP (million francs 1985) {NA}

I_o : income from property and other (incl. self employed) (million francs) {EO}

LF : labour force (1000) {EO}

L^G : government employment (1000) {EO}

L^P : private dependent employment (1000) {EO}

Pc : consumer price index {EO}

Pe : price index of imported intermediate goods {EO}

P*f* : price index of world exports ($) {IFS}

Pm : price index of imported goods and services {EO}

Py : output price index {EO}

RDI : households real disposable income (million francs 1985) {computed}

TB : tax bill and contributions paid by the dependent workers (billion francs) {RS}

t_c : tax rate on profits {RS, EO}

t_g : tax rate on goods and services {RS, EO}

t_o : tax rate on other income {RS, EO}

t_p : private employers' tax rate on labour (contributions to social security) {NA, GGA}

t_w : dependent employees' average tax rate on labour income (including contributions to social security) {NA,RS}

W : gross wage per private dependent employee (francs) {NA}

WB : wage bill of the dependent workers (billion francs) {NA}

W_G : gross wage per public employee (francs) {NA}

Y : real private output (million francs 1985) {EO}

Y_t : real private output, trend value (million francs 1985) {computed}

[1] Mentioning of more than one source means that the relevant variable has been computed