Would shifting the tax burden from labor to capital reduce unemployment?

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1. Introduction

It is often argued that high payroll taxes in Europe are responsible for its unemployment rate. While one possible solution is to reduce the burden of the welfare state, another popular proposal is to change the ¯nancing of the welfare state by shifting taxes from labor to capital. At face value, the idea makes sense, since the pro¯t rate has been soaring while wages have stagnated and joblessness is a key issue. However, increasing taxes on capital clearly reduces capital accumulation and consequently the marginal product of labor at any given employment level. In a world of real wage rigidity this induces an increase in unemployment, which has to be balanced against the drop in unemployment generated by lower payroll taxes. The net e®ect is clearly ambiguous and its sign ultimately depends on the economy's parameters.

The purpose of this paper is to empirically assess the impact of such a tax reform on unemployment. We use a simple neo-classical framework based on a factor-price frontier and a wage curve. We analyze the e®ect of taxes on equilibrium unemployment, and study how a drop in the payroll tax compensated by an increase in the pro¯t tax so as to leave the budget balance una®ected a®ects equilibrium unemployment. We then calibrate the model with realistic parameters which allows to provide a quantitative answer to this question.

The key conclusion is that with realistic parameter values it is unlikely that such a tax reform reduce unemployment: it is more likely to increase it. This is because capital mobility makes the capital tax more distortionary than the labor tax, so that is harms employment more. Indeed, our benchmark simulation with a capital tax of 30 % and a labor tax of 80 %, which yields an unemployment rate of 10 %; is very close to the top of the La®er curve for the capital tax, so that at the margin a very large increase in the capital tax is necessary to compensate for a drop in the labor tax. By contrast, the top of the La®er curve for labor is only reached at a payroll tax of about 200 %.

2. The model

The model we use is a simple two-equation framework which describes the long-run equilibrium of the macroeconomy. There is a constant returns production function, with two factors: labor and capital, so that the product real wage is pinned down by the international rate of return on capital. This is summarized by a factor-price frontier:

$$r(1+t_k) = \phi\left(\frac{w}{A}(1+t_l)\right); \tag{2.1}$$

where r is the required net return on capital, t_k the domestic tax rate on capital, w the take-home real wage, A labor-augmenting technical progress, and t_l the domestic payroll tax. ϕ satisfies the usual properties: $\phi' < 0$; $\phi'' > 0$:

The real wage is in turn related to the equilibrium rate of unemployment through a wage formation schedule:

$$w = Af(u) \tag{2.2}$$

Implicitly the "alternative" wage is proportional to labor-embodied technical progress, so that the natural rate of unemployment is unaffected by productivity growth. This would be the case, for example, if technical change affected market and nonmarket activities similarly. On the other hand, the alternative wage is not affected by the labor tax.

Tax receipts are used to finance an exogenous level of government expenditures (or transfers) G. The budget has to be balanced:

$$w t_l (1 - u) + r t_k k = G,$$

where everything is expressed relative to total labor force. We assume that total expenditures per capita are indexed to productivity, $G = gA$. The budget constraint can then be rewritten, using the fact that the slope of the factor-price frontier in the (w, r) is equal to the labor-capital ratio:

$$t_l \frac{w}{A}(1 - u) - \frac{r(1 - u)t_k}{\phi'(\frac{w}{A}(1 + t_l))} = g \qquad (2.3)$$

Given a tax rate on labour, (2.1), (2.2) and (2.3) together determine the equilibrium values of unemployment, wages and tax rate of capital which satisfy the labor demand, wage setting and balanced budget equilibrium conditions.

The model can then be used to compute the impact on unemployment of any given change in the tax structure.

3. Model calibration

We now calibrate the model's parameters using the French economy as a benchmark. We start with the wage formation schedule (2.2). To being with, we need a measure of total factor productivity A: For this we first computed the Solow residual in a labour-augmenting way:

$$\Delta \log(A_t) = \frac{\Delta \log(Y_t) - s_{kt} \Delta \log(K_t) - s_{Lt} \Delta \log(L_t)}{1 - s_{Lt}}$$

, where s_{Lt} and s_{Kt} are factor shares, Y_t; K_t, and L_t; GDP, capital and employment in the private sector. The data that were used are the OECD Economic Outlook statistics on microcomputer diskette.

By setting an initial value of 0 for $\log(A_t)$ we can then compute a time series for technical progress. This series is however unadjusted for cyclical fluctuations, although in the long run this is a minor problem. To tackle this problem we have removed from $\Delta \log(A_t)$ the component systematically correlated with the cycle — as measured by the rate of capacity utilization — which yields a cyclically adjusted measure of technical progress.

A dynamic wage curve was then estimated for the French economy over the 1965-1995 period using two stage least squares, giving the following result:

$$\log\left(\frac{w_t}{A_t}\right) = \underset{(1.47)}{0.71} + \underset{(11.4)}{0.89}\log\left(\frac{w_{t-1}}{A_{t-1}}\right) - \underset{(-2.0)}{0.067}\log(u_t)$$

$R^2 = 0.967$; DW=1.75

The unemployment rate was instrumented with an aggregate demand variable, namely public consumption.

Since the above model is best designed to capture the long run behaviour of the economy (it has no adjustment costs for labor or capital), we shall use an isoelastic wage curve with an elasticity equal to the long-run value predicted by the above equation:

$$w = ACu^{-\varepsilon};\ \varepsilon = 0.6$$

As for the factor price frontier, we simply recover it from a Cobb-Douglas production function with coefficients 0.7 and 0.3 on labor and capital, or equivalently:

$$r(1+t_k) = b\left(\frac{w}{A}(1+t_l)\right)^{-\eta};\ \eta = 2.3$$

As for the other parameters, we set the international required real return on capital to 0.05. C and b only matter in the determination of equilibrium through $z = C^{-\eta}b$. We calibrate it so that a set of tax rates equal to $t_k = 0.3$ and $t_l = 0.8$

yield an unemployment rate of $u = 0.1$.[1] These values roughly match those of the French economy. They also pin down the value g of government expenditure, relative to productivity.

4. Numerical results

We are now, with the model and numerical parameters, in a position to answer the question in which we are interested: what is the impact of a fall in the payroll tax on equilibrium unemployment?

Table 1 reports how the tax on capital and the unemployment rate vary for small variations of the labour tax rate around the benchmark simulation. The key conclusion is twofold. First, a large increase in the tax rate on capital is necessary to maintain a balanced budget in compensation of a small drop in the tax rate on labour. Second, this implies a moderate increase in the unemployment rate.

[1] The formula is $z^{-1/\eta} = u^{¨}(r(1+t_k))^{-1/\eta}/(1+t_l)$

t_l	t_k	u (%)	¢Y=Y (%)
0.79	0.39	10.4	-3.4
0.8	0.3	10	0
0.81	0.25	9.7	2.7
0.82	0.21	9.7	3.2
0.83	0.18	9.6	4.5
0.84	0.16	9.6	5.0

This simulation suggests, somewhat paradoxically, that shifting taxes from capital to labour is the right way to go. Although it has small e®ects on employment, the e®ects on output are larger: a 5% increase in the labor tax can be matched by almost a halving of the capital tax, with a 5% gain in aggregate output.

This paradox is further illustrated on ¯gure 1, which is representing the unemployment rate as a function of tax rates on labor and capital. While unemployment is much more reactive to a one percent increase in labor taxes than a to a one percent increase in capital taxes, nevertheless a large increase in capital taxes is needed to compensate for a small reduction in labor taxes, so that unemployment actually rises. What is driving the result is that because capital is internationally mobile, the capital tax is much more distortionary than the labor tax; accordingly the La®er curve associated with t_k is much °atter than the one associated with

t_l (See ¯gure 2): a large increase in t_k is thus needed to balance a small decline in t_l; and because of the downward pressure on wages generated by the capital °ight, unemployment has to rise. Indeed, our benchmark simulation turns out to be very close the top of the La®er curve for the capital tax. We ¯nd that it is impossible to match a fall of the labor tax from 80 % to 78 % with an increase in the capital tax such as the budget remains balanced.

The model also implies that a fall in unemployment can be obtained by reducing public expenditures. table 2 reports the impact on unemployment of a reduction in public expenditures with respect to the benchmark simulation, where labor and capital tax rates have been reduced by the same amount. We see that a 10 % reduction in expenditures reduces unemployment by 2 %.

¢g=g (%)	t_l	t_k	u (%)
0	0.8	0.3	10
0.99	0.782	0.282	9.7
0.97	0.75	0.25	9.2
0.95	0.72	0.22	8.8
0.9	0.66	0.16	8.0

5. Going further: adjustment costs on labor and capital

The above analysis is essentially interested in the long run impact on unemployment of a change in the tax structure. One may also rise the problem of the transition towards this new equilibrium. That is, shifting taxes to capital may yield transitory employment gains even though employment falls in the long run. This possibility should be taken seriously, because it opens the possibility of accumulating budget surpluses during the high employment phase, which allows for a lower increase in the capital tax, which may eventually reverse the negative impact on unemployment in the long-run.

In this section we extend the analysis by introducing adjustment costs to capital. But, given that labor adjustment is also costly, particularly in Europe where regulation makes firing difficult, we also have to take this into account.

We assume that the law sets a constant tax rate on both labor and capital. Firms maximize:

$$\max_{H_t;I_t;K_t;L_t} \int_0^{+1} (K_t^{\alpha}(A_tL_t)^{1-\alpha} - w_t(L_t + c\frac{H_t^2}{2L_t})(1+t_l) - (I_t + b\frac{I_t^2}{2K_t}))e^{-\rho t}dt \quad (5.1)$$

, subject to:

$$\dot{K}_t = I_t - \delta_K K_t$$

$$\dot{L}_t = H_t - \delta_L L_t$$

, where I is investment, H gross hires, $c\frac{H_t^2}{2L_t}$ labor adjustment costs and $b\frac{I_t^2}{2K_t}$

capital adjustment costs. Note that each adjustment cost uses the factor which is being adjusted only, so that labor taxes increase labor adjustment costs. We have assumed a constant relative price of capital goods, which we normalize to one. ρ is the required gross return on capital, given the capital tax.

Let τ_K be the tax on capital income, including dividend payments and capital gains. Let r be the required net return on capital, which we assume exogenous (given by the international rate of return or the consumer's rate of time preference). Then the value of the firm V_t must satisfy the following arbitrage equation:

$$rV_t = (D_t + \dot{V}_t)(1 - \tau_k)$$

, where D_t is the dividend being paid, that is the in brackets in the above integral. Integrating this formula forward, we see that the firm's value is given by the above integral, with the gross required return being equal to:

$$\rho = r/(1 - \tau_k);$$

and tax receipts being $\tau_k(D_t + \dot{V}_t) = \tau_k rV_t/(1 - \tau_k)$: We can then reintroduce the notations of the first section by denoting $t_k = \tau_k/(1 - \tau_k)$ the tax rate expressed in terms of net rather than gross capital income, yielding $\rho = r(1 + t_k)$ and tax receipts equal to $t_k rV_t$:

The Hamiltonian of (5.1) is given by:

$$H = e^{-r(1+t_k)t}\left[K_t^{\alpha}(A_t L_t)^{1-\alpha} - w_t\left(L_t + c\frac{H_t^2}{2L_t}\right)(1+t_l) - \left(I_t + b\frac{I_t^2}{2K_t}\right)\right]$$
$$+ q_t e^{-r(1+t_k)t}[I_t - \delta_K K_t] + z_t e^{-r(1+t_k)t}[H_t - \delta_L L_t]$$

The first-order conditions are given by:

$$\alpha A_t^{1-\alpha}(K_t/L_t)^{\alpha} - w_t(1+t_l) + \frac{cH_t^2}{2L_t^2}w_t(1+t_l) - \delta_L z_t = -\dot{z}_t + r(1+t_k)z_t \quad (5.2)$$

$$(1-\alpha)A_t^{1-\alpha}(K/L)^{\alpha-1} + \frac{bI_t^2}{2K_t^2} - \delta_K q_t = -\dot{q}_t + r(1+t_k)q_t$$

$$I_t/K_t = (q_t - 1)/b$$

$$H_t/L_t = \frac{z_t}{c(1+t_l)w_t}$$

It is clear from (5.2) that the tax on capital tends to depress the shadow value of labor z_t: Under labor adjustment costs capital taxation now has a direct negative impact on the incentive to hire as hiring somebody is now an investment decision: the hiring cost must be paid by lenders and shareholders before the benefits from that investment are reaped.

Finally, given the empirical evidence, we also introduce dynamics in the wage curve, which may be due, for example, to habit formation in wage aspirations:

$$\dot{w}_t/w_t = -\lambda(w_t - A_t f(u_t))$$

We assume a balanced budget in intertemporal terms:

$$\int_0^{+\infty} (t_l w_t(1-u_t) + t_k r q_t k_t) e^{-rt} dt = G/r$$

Note that capital taxation introduces a discrepancy between the discount rate faced by the government and the one faced by firms. Also, we have applied Hayashi's result that $V_t = q_t K_t$ under constant returns.

Our strategy for solving the model is as follows. For any pair (t_l, t_k) we compute the economy's trajectory as follows. First we compute the steady state. Then, given the steady state values of q and z, we can compute forward the path followed by the state variables K_t, L_t and w_t if q_t and z_t were constant and equal to these steady state values. Given this path for the state variables, we can compute backwards the corresponding path for the co-state variables q and z. This new path allows to compute a new path for the state variables. We repeat this procedure until it converges to a fixed point.

This algorithm yields an equilibrium which does not satisfy the balanced budget condition. We next compute the capital tax rate which meets it given this equilibrium path, and repeat the procedure, again, until a fixed point is reached.

5.1. Model Calibration

[To be completed]

Figure 1

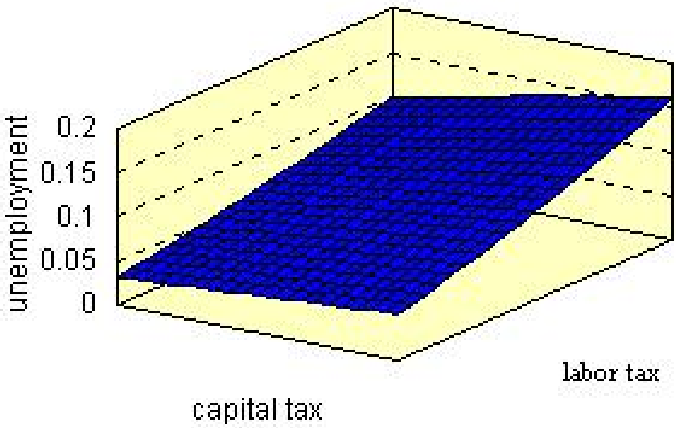

Figure 2