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Social Security, Unemployment, and Growth

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ABSTRACT

The paper develops an overlapping generations model that highlights interactions between social security, unemployment and growth.The social security system has two components: old age pensions and unemployment insurance. Pensions have a direct effect on economic growth. Both pensions and unemployment benefits influence equilibrium unemployment caused by wage bargaining. Since unemployment impairs growth, both types of social security have an indirect, negative effect on growth.

JEL classification:. E24, H55, J51, J64, J65

Keywords:. unemployment benefit, pensions, wage bargaining, endogenous growth

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1 Introduction

Most European countries are plagued with high unemployment and slow economic growth. In the debate on economic policy, both unemployment and economic growth are often related to the rise in wage-dependent social security contributions. Since aging of societies is likely to increase these contributions even further, social security reforms are high up on the policy agenda. This paper contributes to the analysis of the relationship between social security, unemployment and growth. To do this, the paper develops a model that highlights some important institutional features of European welfare states and labour markets: Firstly, there is a social system with two components: old age pensions and unemployment insurance. Secondly, on the labour market there is equilibrium unemployment caused by wage bargaining between unions and firms.

While the relation between social security, unemployment and growth is essential in the eyes of policy makers and laymen, it is mostly ignored in theoretical literature. Here the relation between unemployment insurance and unemployment receives extensive treatment, see Nickell and Layard (1999) for a recent overview. The relation between pensions and growth has also received some attention, see Saint-Paul (1992) and Belan et al. (1998). Further, there are some recent papers relating unemployment and growth. Most of them follow Aghion and Howitt (1994) and Pissarides (2000) and consider unemployment caused by search frictions and growth. Bräuninger (2000) and Lingens (2003) consider unemployment caused by wage bargaining and growth. In these models unemployment impairs growth. Daveri and Tabellini (2000) argue that the increase in unemployment and the reduction in economic growth are caused by the increase in the tax on labour income. As the labour income tax includes social security contributions there is some indirect link from pensions to unemployment and growth. The only paper considering the relation between social security, unemployment and growth explicitly is Corneo and Marquardt (2000). Even though their model is very similar in spirit to the one presented in the following sections, their results differ remarkably. Therefore, the final section will discuss the differences between the two papers in detail.

The paper proceeds as follows: Section 2 introduces social security. Then, Section 3 presents the model of wage bargaining. The typical setting of this model is presented in Layard et al. (1991). It assumes unions to be large enough to have market power and small enough to ignore the macroeconomic effects of their actions. In addition, imperfect competition on the product market is admitted so that firms make profits. Unions in turn can try to obtain part of these profits by bargaining. The basic argument is that bargaining pushes the wage above the competitive level. As a consequence, some individuals become unemployed. In the short run, the reduction in labour input increases the marginal product of labour. However, in the long run the effect on capital accumulation has to be considered. So Section 4 adds the process of capital accumulation within an endogenous growth model in the spirit of Romer (1986) and Lucas (1988). The microfoundation for the consumption savings decision is given by an onverlapping generations model in the tradition of Diamond (1965). Finally, Section 5 discusses the basic assumption and relates the results to those previously obtained in the literature.

2 Social Security

The social security system has two components: old age pensions and unemployment insurance. At each point in time, the population consists of two generations, the young and the old. The number of the young is N and the number of the old is N_{-1}. The relation between the size of the old and the young generation is given by the constant labour growth rate $n = N/N_{-1} - 1$. Each young individual supplies one unit of labour. However, the proportion u is unemployed and so there are $(1-u)N$ working individuals. Each of them earns the wage w. The wage is taxed to finance old age pensions and unemployment insurance.

First consider old age pensions. The number of the old is N_{-1}. Each old individual receives a pension P which is proportional to the wage $P = pw$, with

$p < 1$ being the pension ratio. Pensions expenditures are pwN_{-1}. These are financed by a tax t_p on wage income. Hence, the old age pensions budget restrictions is $t_p w(1-u)N = pwN_{-1}$, which gives:

$$t_p = \frac{p}{(1-u)(1+n)} \tag{1}$$

Now consider unemployment insurance. Here the tax on wage income of $(1-u)N$ working individuals has to finance unemployment benefits for the unemployed. Unemployment benefits are fixed in relation to the wage $B = bw$, with $b < 1$ being the replacement ratio. The number of the unemployed is uN and so unemployment insurance expenditures are $bwuN$. Then the unemployment insurance budget restriction is $t_u w(1-u)N = buwN$ which gives:

$$t_u = \frac{bu}{(1-u)} \tag{2}$$

The total tax levied on wage income of the working generation is:

$$t = t_p + t_u = \frac{p + bu(1+n)}{(1-u)(1+n)} \tag{3}$$

The tax is negatively related to labour growth and is positively related to the replacement ratio b, the pension ratio p, and the unemployment rate u.

3 Wage Bargaining

There is a large number of firms. Each firm i uses capital K_i and a homogenous amount of labour L_i to produce a variety of other goods. All goods are imperfect substitutes and firms act under monopolistic competition. Firm i faces a demand function $Y_i = \pi_i^{-\eta} Y$, where Y_i is the demand for the good produced by firm i, π_i is the relative price of that good, η is the price elasticity of demand, and Y is an index of aggregate demand. Firms maximize profits $\Pi_i = R_i - w_i L_i - rK_i$, where $R_i = \pi_i Y_i$ is revenue, w_i is the wage in firm i, and r is the market interest rate. Insert the inverse demand function to obtain $R_i = Y^{1/\eta} Y_i^{\kappa}$, with $\kappa = 1 - 1/\eta$. The production function is assumed to be of the Cobb-Douglas type $Y_i = AK_i^{\alpha}(E_iL_i)^{\beta}$, with $\alpha+\beta = 1, \alpha, \beta > 0$, A as general index of efficiency, and E_i as a labour efficiency index. Profit maximization implies that the marginal revenue of labour equals the wage rate $\partial R_i/\partial L_i = \beta\kappa R_i/L_i = w_i$. The rate of return on capital is given as revenue minus labour cost per unit of capital $r_i = (R_i - w_iL_i)/K_i = (1-\beta\kappa)R_i/K_i$.

Workers of each firm are represented by a union. Unions maximize the utility of a representative worker, see Booth (1995). The union has N_i members, and the utility of a risk-neutral representative member is $v_i = (1-u_i)(1-t)w_i + u_ia_i$, where $1-u_i$ is the probability of a union member being employed by firm i, with $u_i = (N_i - L_i)/N_i$. When employed in firm i, the union member receives a net income of $(1-t)w_i$, where t is the tax rate. When not employed in firm i, the union member receives the alternative income a_i. In that case, the worker either becomes unemployed and receives unemployment benefit, or finds a job in another firm and receives the net wage paid by other firms. The probability of finding a job in another firm depends on the strain on the labour market. This probability as well as wages paid by other firms and the tax rate are exogenous in the bargaining process. The number of union members is also exogenous and therefore the union might equivalently maximize $V_i = N_iv_i = L_i((1-t)w_i - a_i) + N_ia_i$.

Unions and firms bargain over the real wage. It is assumed that bargaining leads to the maximization of the Nash product: $\Omega = (V_i - \overline{V}_i)^{\gamma}(\Pi_i - \overline{\Pi}_i)^{1-\gamma}$, where γ defines the relative bargaining power of unions and firms. With $\gamma = 1$, we have a monopoly union and with $\gamma = 0$ there is no union power, and the wage is set by firms. $\overline{V_i}$ and $\overline{\Pi}_i$ are union utility and firms' profits respectively for the case of no solution to the bargaining process. If no settlement is reached, all union members receive the alternative income $\overline{V}_i = a_iN_i$; while firms will not produce and incur a loss to the extent of the costs of capital $\overline{\Pi_i} = -rK_i$. This implies that the Nash product is: $\Omega = (L_i((1-t)w_i - a_i))^{\gamma}(R_i - w_iL_i)^{1-\gamma}$. Maximization of the Nash product leads to:

$$(1-t)w_i = \mu a_i \text{ with } \ \mu \equiv 1-\gamma+\frac{\gamma}{\beta\kappa} \tag{4}$$

The wage in firm i is set as a fixed mark-up μ over alternative income. The mark-up increases with union power γ, and declines with both competitiveness κ, and the elasticity of production with respect to labour β. With no union power ($\gamma = 0$) the net wage corresponds to alternative income ($\mu = 1$).

Union members not employed in firm i become unemployed. Following Layard and Nickell (1990), it is assumed that during each period there are fluctuations on the labour market. Hence, there is a chance for unemployed workers to become employed during the period. The probability of staying unemployed during the whole period is φu, where u is the unemployment rate and φ is negatively related to the size of labour market fluctuations. The probability of becoming employed in another firm is $1-\varphi u$. When unemployed workers find a job they will receive the same net income as those workers employed in other firms, $(1-t)w$. They receive unemployment benefits B during unemployment. Under these assumptions the alternative income is given by:

$$a_i = \varphi ubw + (1-\varphi u)(1-t)w \tag{5}$$

Insert (5) into (4) to obtain:

$$(1-t)w_i = \mu\left(\varphi ubw + (1-\varphi u)(1-t)w\right) \tag{6}$$

Now assume that all firms are the same and therefore $w_i = w$. Insert this into (6) and solve for the unemployment rate:

$$u = \frac{(\mu-1)(1-t)}{\mu\varphi\,(1-t-b)} \tag{7}$$

The equilibrium unemployment rate depends on the tax rate. However the tax rate depends on the unemployment rate as has been shown in (3). To find the equilibrium we have to solve the system of equations (3) and (7). The solution allows us to state:

Proposition 1 *There are either two unemployment equilibria or no equilibrium exists.*

Proof. Insert the tax rate from (3) into (7) and rearrange to obtain a quadratic equation for the equilibrium unemployment rate: $u^2 - Pu + Q = 0$, with $P = ((1-b+m+mb)(1+n)+p)/(1+n)$, $Q = m(1+n-p)/(1+n)$ and $m = (\mu-1)/\mu\varphi$. The solutions to this quadratic equation are $u_{1,2} = P/2 \pm \sqrt{P^2/4 - Q}$. The solutions are real if $P^2/4 > Q$. In this case there are two equilibria since $P > 0, Q > 0$ and therefore $P/2 - \sqrt{P^2/4 - Q} > 0$. In the case $P^2/4 < Q$ there is no solution and hence no equilibrium. ■

Figure 1 illustrates the two equilibria. The $u(t)$ line shows how unemployment depends on the tax rate and the $t(u)$ line shows how the tax rate depends on the unemployment rate. There are two intersections of the two lines at t_1u_1 and at t_2u_2. These intersections represent the two equilibria.

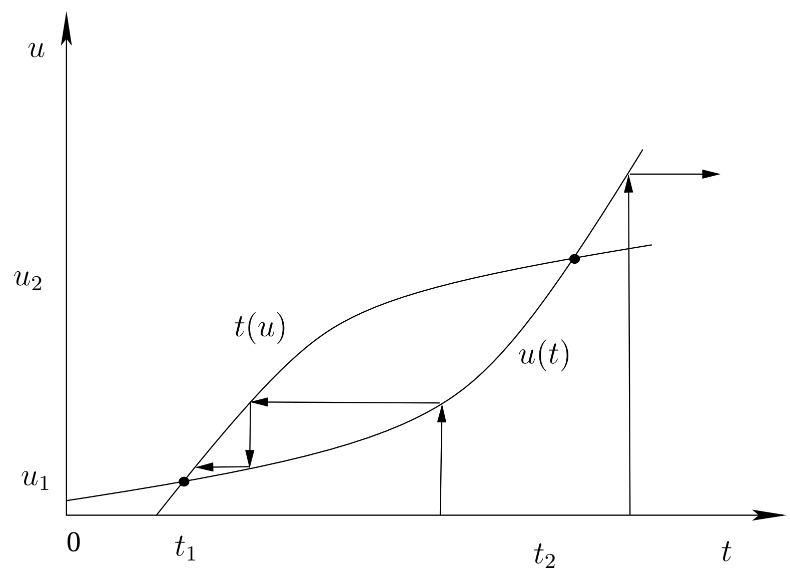

Figure 1: Unemployment Equilibria

Starting with a tax rate t_3, between t_1 and t_2, we obtain an unemployment rate between u_1 and u_2. This unemployment rate corresponds to a tax rate below t_3. As a consequence, tax and unemployment rates converge to the equilibrium (t_1, u_1). If the initial tax and unemployment rates are above (t_2, u_2), then tax and unemployment rates explode and there is no convergence to a steady state. So the low unemployment steady state is locally stable, while the high unemployment steady state is unstable.

Proposition 2 *An increase in the replacement ratio or in the pension ratio leads to an increase in the tax rate and in the unemployment rate. The same applies to a decline in population growth. Neither the output level nor output growth affects tax and unemployment rates.*

Proof. From (3) and (7) we have $\partial t/\partial b > 0$ and $\partial u/\partial b > 0$. Hence an increase in the replacement ratio implies that the function $u(t)$ shifts upwards and the function $t(u)$ shifts to the right. Both imply that the $u_1 t_1$ equilibrium shifts to a higher level of unemployment and tax rates. We have $\partial t/\partial p > 0$ and $\partial u/\partial p = 0$. So an increase in the pension ratio shifts the $t(u)$ function to the right. Finally we have $\partial t/\partial n < 0$ and $\partial u/\partial n = 0$. So a reduction in population growth shifts the $t(u)$ function to the right. ■

Proposition 2 implies that there is a maximum for the replacement ratio and for the pension ratio. If either of them is pushed up to far, there will be no intersection between the $u(t)$ and the $t(u)$ line. This implies that there is no equilibrium and the unemployment rate goes to 1, so the economy collapses. Since the tax rate depends on population growth, the critical level for the pension and replacement rate declines if population growth declines. In the following we assume, that the replacement rate and the pension rate are sufficiently low.

Now we consider aggregate production. Since all firms are identical and all unions are identical, all firms face equal cost and demand functions. The real wage is determined by wage bargaining. Due to symmetry of firms, all prices will be equal, and the relative price is $\pi = \pi_i = 1$. Then revenue by each firm is equal to output $R_i = Y_i = AK_i^\alpha(EL_i)^\beta$. The production function is the same for all firms. Hence, aggregate output is $Y = AK^\alpha(EL)^\beta$, where K represents aggregate capital and L aggregate labour input. Aggregate labour input is determined by wage bargaining. Aggregate labour input depends on the unemployment rate determined by wage bargaining and on labour supply $L = (1-u)N$. The aggregate production function can be stated as $Y = AK^\alpha(1-u)^\beta E^\beta N^\beta$. To capture the basic idea of endogenous growth models in the spirit of Romer (1986) and Lucas (1988) we assume that labour efficiency depends on aggregate accumulated knowledge which is assumed to be proportional to aggregate capital in relation to labour supply $E = K/N$. The assumption that labour efficiency depends on the relation between agrregate capital and labour supply is essential for some of the results and will therefore be closly discussed against alternatives in the final section. As a consequence, the production function is of the AK type:

$$Y = AK(1-u)^\beta \tag{8}$$

The wage rate is given by the marginal product of labour and the interest rate is $r = (Y - wL)/K$. So we obtain:

$$w = \frac{\partial Y}{\partial L} = \frac{\beta\kappa AK}{(1-u)^\alpha N} \text{ and } r = (1-\beta\kappa)A(1-u)^\beta \tag{9}$$

The wage rate is proportional to capital per worker and the interest rate is constant. An increase in the unemployment rate leads to a decline in output, to an increase in the wage rate and to a decline in the interest rate. However, these are only the short-term effects, since they rely on a given capital stock. In the next section, capital will be endogenously determined.

4 Growth

A simple two-period overlapping generations model serves for the microfoundation of the consumption savings decision. The individual lifecycle is composed of two periods: the working period and the retirement period. At the end of the working period, each individual gives birth to $1+n$ children. Hence, the population growth rate is given by n. During the working period individuals either work and receive wage income or they are unemployed and receive unemployment benefit. If they work they have to pay taxes to finance unemployment insurance and pensions. The remaining income is partly used for consumption during the working period and partly saved. Savings are invested. In the retirement period, individuals earn interest on capital and sell capital altogether. In addition they receive pensions. All proceeds are entirely consumed and no bequest is left. Individuals are assumed to have identical preferences. Utility U depends on the consumption during youth c^1 and during old age c^2. The preference structure is described by a Cobb-Douglas type utility function:

$$U = (1-\delta)\log c^1 + \delta \log c^2$$

where δ denotes the individual rate of thrift. While they are young, individuals either work or are unemployed. If they work, their income I is given by net wage $I = (1-t)w$; and if they are unemployed, their income is given by unemployment benefits $I = bw$. Income can either be consumed or saved s. This gives the individual budget constraint for the first period: $I = c^1 + s$. Savings are invested into physical capital and earn the constant interest r. Consumption in the second period is financed by pensions, savings and their proceeds: $c^2 = (1+r)s + pw_{+1}$. Maximization of the utility function subject to the budget constraints gives the individual savings function:

$$s = \delta I - \frac{(1-\delta)pw_{+1}}{(1+r)}$$

Individual savings depends on individual income during the working period and on the level of pensions. Relevant for growth are aggregate savings of the young. These are the sum of savings of those employed and of those unemployed. The proportion of employed is $(1-u)$ and their individual income is $(1-t)w$; the proportion of unemployed is u and their income is bw. So aggregate savings are:

$$S = \delta(1-t)(1-u)wN - \frac{(1-\delta)pw_{+1}}{(1+r)}(1-u)N + \delta buwN - \frac{(1-\delta)pw_{+1}}{(1+r)}uN$$

Notice that the unemployment insurance budget restriction implies that the contributions of the working correspond to the benefits paid to the unemployed, i.e. $t_u(1-u)wN = buwN$, to simplify:

$$S = \delta(1-t_p)(1-u)wN - \frac{(1-\delta)pw_{+1}}{(1+r)}N$$

Savings depend on the wage rate, on the unemployment rate and on the pension ratio. They are independent of the replacement ratio. This is due to the purely redistributionary nature of unemployment benefit: income taxed away from the employed is given to the unemployed. The latter save in the same proportion as the employed and therefore aggregate savings are not directly affected.

Savings depend on the pension ratio. An increase in the pension ratio affects savings for two reasons: firstly, it increases contributions of the currently young and so their net-income declines ($\partial t_p/\partial p > 0$). Secondly, it affects the young's motivation to save, since part of their old age consumption is financed by the next period's pensions. These depend on the pension ratio and on the next period's wage. The wage is proportional to output, which is proportional to capital. Insert the wage and the interest rate from (9) into the savings function to obtain:

$$S = \delta(1-t_p)(1-u)\frac{\beta\kappa AK}{(1-u)^{\alpha}} - \frac{(1-\delta)p}{(1+(1-\beta\kappa)A(1-u)^{\beta})}\frac{\beta\kappa AK_{+1}}{(1-u)^{\alpha}N_{+1}}N \tag{10}$$

Capital in the next period is financed by savings of the young $K_{+1} = S$. The growth factor of capital is then given by: $g = K_{+1}/K = S/K$. Use the savings function

(10), $K_{+1} = gK$, and $N_{+1} = (1+n)N$ to obtain an implicit function for the growth factor:

$$g = \delta(1-t_p)(1-u)\frac{\beta\kappa A}{(1-u)^{\alpha}} - \frac{(1-\delta)pg}{(1+(1-\beta\kappa)A(1-u)^{\beta})}\frac{\beta\kappa A}{(1+n)(1-u)^{\alpha}} \tag{11}$$

Analysis of (11) gives:

Proposition 3 *An increase in unemployment reduces growth. An increase in the pension ratio also reduces growth. An increase in population growth increases growth.*

Proof. Equation (11) might be stated as:

$$F = g - \delta\beta\kappa A(1-t_p)(1-u)^{\beta} + \frac{(1-\delta)pg\beta\kappa A}{((1-u)^{\alpha} + (1-\beta\kappa)A(1-u))\,(1+n)} = 0$$

For the partial derivatives we obtain:

$$\begin{aligned}
F_g &= 1 + \frac{(1-\delta)p\beta\kappa A}{(1+n)\left((1-u)^{(1-\beta)} + (1-\beta\kappa)A(1-u)\right)} \\
F_u &= \delta\beta\kappa A(1-t_p)\beta(1-u)^{\beta-1} + \delta\beta\kappa A(1-u)^{\beta}\frac{\partial t_p}{\partial u} \\
&\quad + \frac{(\alpha(1-u)^{-\beta} + (1-\beta\kappa)A)(1-\delta)pg\beta\kappa A}{(1+n)((1-u)^{1-\beta} + (1-\beta\kappa)A(1-u))^2} \\
F_p &= \delta\beta\kappa A(1-u)^{\beta}\frac{\partial t_p}{\partial p} + \frac{(1-\delta)g\beta\kappa A}{((1-u)^{\alpha} + (1-\beta\kappa)A(1-u))\,(1+n)} \\
F_n &= \delta\beta\kappa A(1-u)^{\beta}\frac{\partial t_p}{\partial n} - \frac{((1-u)^{\alpha} + (1-\beta\kappa)A(1-u))\,(1-\delta)pg\beta\kappa A}{((1-u)^{\alpha} + (1-\beta\kappa)A(1-u))^2\,(1+n)^2}
\end{aligned}$$

Due to $\partial t_p/\partial u > 0$, $\partial t_p/\partial p > 0$, and $\partial t_p/\partial n < 0$, we obtain $F_u > 0, F_p > 0$, and $F_n < 0$. In addition we have $F_g > 0$. Applying the implicit function theorem then gives $\partial g/\partial u = -F_u/F_g < 0, \partial g/\partial p = -F_p/F_g < 0, \partial g/\partial n = -F_n/F_g > 0$. ■

Now what is the intuition behind theses effects and what are the policy implications? Growth is negatively related to unemployment, because unemployment implies lower output and therefore lower savings. An increase in the pension ratio has a direct negative effect on growth because it leads to a decline in savings. There is an additional indirect effect. Higher pensions lead to higher contributions and therefore to higher unemployment which implies lower growth. If population growth increases, pension contributions decline and so savings increase and unemployment declines. Both foster growth. Finally an increase in the replacement rate leads to higher unemployment and, therefore, to lower growth.

5 Discussion

The basic mechanism behind the model is that social security affects unemployment and growth. In addition, unemployment has a negative effect on growth, while growth has no direct effect on unemployment. Now we will discuss the linkages in turn.

First, consider the relation between unemployment and growth. An increase in unemployment leads to reduced growth, since unemployment reduces aggregate income, savings and capital accumulation. Labour efficiency $E = K/N$ is not directly affected by unemployment. Lower capital growth then implies lower labour efficiency growth. Therefore the aggregate growth rate declines. This contrast with the closely related model of Corneo and Marquardt (2000). In their model, unemployment does not affect growth. This is due to the fact that they assume that the labour efficiency depends on capital per employed worker $E = K/[(1-u)N]$. Hence, any increase in unemployment increases labour efficiency. So the production function simplifies to $Y = AK$, and production is independent of (un)employment. However, empirical evidence in Daveri and Tabellini (2000) and in Bräuninger and Pannenberg (2002) suggests that unemployment reduces growth.

Now we shall look take at the reverse causality. In the model presented here, unemployment is not affected by growth. In models of the Aghion and Howitt (1994) type, an increase in growth goes along with an increase in creative destruction. So growth is positively related to the labour turnover rate and, therefore, an increase in growth might lead to an increase in unemployment. In Bräuninger (2000) it is shown that this feedback from growth to unemployment mitigates the negative effects from unemployment to growth, but it does not reverse them. So the policy conclusions of the present model are not changed.

Second, consider the relation between social security and unemployment. In the present model an increase in unemployment benefits leads to higher unemployment as does an increase in either of the social security contribution rates. In Corneo and Marquardt (2000) neither the level of benefits nor the contribution rates have an impact on unemployment. They assume that the wage is set by a monopoly union, that pursues two targets, a high mark-up over the competitive wage and low unemployment. In contrast, here we have many competing unions, each of them maximizes utility of representative members. Their utility depends on the bargained wage, on the probability of becoming unemployed and on the alternative wage. The alternative income is a weighted average of wages paid in other firms and of unemployment benefits. This gives a robust linkage from unemployment benefit to unemployment, see Nickell and Layard (1999). However, whether contribution rates matter is not so obvious. If unemployment benefits are proportional to net wages, then unemployment becomes independent of contribution rates: $u = (\mu - 1)/[\mu\varphi(1-b)]$. As a consequence, unemployment is also independent of the pension ratio. There are intermediate cases where unemployment benefits depend to some extent on net and to some extent on gross wages. For instance, this is the case if there are contributions from both worker and firm, and benefits are linked to wages net of workers contributions only. In that case the model is structurally identical to the one where contributions are linked to gross wages, see Pflüger (1997) and Pissarides (1998) for further discussions.

Third, consider the relation between social security and growth. In the model presented here as well as in Corneo and Marquardt (2000) the pension system has negative growth effects. The reason in both models is that pensions crowd out savings, and therefore reduce capital formation and growth. In both models an increase in unemployment insurance leads to higher contributions and therefore reduces net wage and savings of employed workers. However, the increase in benefits allows unemployed workers to save more. These two effects cancel each other out, and so there is no effect on growth via savings. However, in the present model, the increase in the replacement ratio leads to an increase in unemployment, which in turn reduces growth.

References

Aghion, P., Howitt P. (1994) Growth and Unemployment, Review of Economic Studies 61, 477 - 494.

Belan, P., Michel, P., Pestieau, P. (1998) Pareto-improving Social Security Reform with Endogenous Growth, The Geneva Papers on Risk and Insurance Theory 23, 119 - 125.

Booth, A. L. (1995) The Economics of the Trade Union, Cambridge.

Bräuninger, M., Pannenberg, M. (2002) Unemployment and Productivity Growth: An Empirical Analysis within the Augmented Solow Model, Economic Modelling 19, 105 - 120.

Bräuninger, M. (2000) Wage Bargaining, Unemployment and Growth, Journal of Institutional and Theoretical Economics 156, 646 - 660.

Corneo, G., Marquardt, M. (2000) Public Pensions, Unemployment Insurance, and Growth, Journal of Public Economics, 75, 293 - 311.

Daveri, F., Tabellini, G. (2000) Unemployment, Growth and Taxation in Industrial Countries, Economic Policy, 49 - 104.

Diamond, P. A. (1965) National Debt in a Neoclassical Growth Model, American Economic Review, 55, 1126 - 1150.

Layard, R., Nickell, S., and Jackmann, R. (1991) Unemployment. Macroeconomic Performance and the Labour Market, Oxford University Press: Oxford.

Lingens, J. (2003) The Impact of a Unionised Labour Market in a Schumpeterian Growth Model, Labour Economics 10, 91 - 104.

Nickell, S., Layard, R. (1999) Labor Market Institutions and Economic Performance, 3029 - 3084 in: O. Ashenfelter (ed.), Handbook of Labor Economics, Elsevier: Amsterdam, .

Lucas, R.E. (1988) On the Mechanics of Economic Development, Journal of Monetary Economics, 22, 2 - 42.

Pissarides, C. A. (1998) The Impact of Employment Tax Cuts on Unemployment and Wages; The Role of Unemployment Benefits and Tax Structure, European Economic Review 42, 155 - 183.

Pissarides, C. A. (2000) Equilibrium Unemployment Theory, The MIT Press, Cambridge, MA.

Pflüger, M. P. (1997) On the Employment Effects of Revenue Neutral Tax Reforms, Finanzarchiv 54, 430 - 446.

Romer, P. (1986) Increasing Returns and Long-Run Growth, Journal of the Political Economy, 94, 1002 - 1035.