Income Taxation, Old Age Pensions and Disability Benefits*

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Abstract

This paper concerns two issues related to optimal income taxation. First, we show how the labor income tax and the old age pension system interact in the optimal tax and expenditure structure. Second, we derive marginal capital income tax rates for high-ability and low-ability working individuals as well as for the disabled.

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1 Introduction

There is a large literature on how public old age pensions and disability pensions affect the resource allocation. In the context of optimal nonlinear income taxation, on the other hand, there are very few studies on how different parts of the social insurance system interact with the tax system in order

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to redistribute income in an optimal way. An important exception is Cremér et al. (2002) analyzing how public pensions interact with an optimal general income tax in a model where the labor supply has two dimensions: hours of work and retirement age. Boadway et al. (1999) address disability benefits in an optimal tax framework. Their main contribution is to characterize the optimal tax and transfer system in an economy where the government operates a costly welfare system.

The purpose of this short paper is to discuss two aspects of the interaction between public pensions and income taxation. First, if the government does not observe differences in productivity among working individuals, the efficient public policy implies a restriction on the sum of the marginal labor income tax rate and the present value of the marginal pension benefit. Second, if health status is unobservable, it is important to design the tax and benefit system in a way such that individuals able to work do not want to mimic the behavior of the disabled. We show how the capital income tax may play an important role in this context. The analysis is based on an extension of Stiglitz' (1982) self-selection approach to optimal taxation. In particular, we consider the overlapping generations (OLG) model analyzed by Pirttilä and Tuomala (2001), which is here extended to reflect the behavior of three types: high-ability individuals, low-ability individuals and disabled.

2 The Model and the Results

Starting with the consumption side of the model, the utility function facing an individual of type i born in period t is given by

$$U_t^i = U(c_{1t}^i, z_t^i, c_{2t+1}^i; \beta^i) \tag{1}$$

where c_{1t} denotes consumption when young and c_{2t+1} consumption when old, whereas z_t is leisure. The individual only works when young, and the hours of work are given by $l_t^i = H - z_t^i$, where H is a time endowment. The term β^i is an indicator of health status; it takes the same value for the employed low-ability and high-ability types, while it takes a different value for the disabled. If working, the budget constraint is written

$$w_t^i l_t^i - T(w_t^i l_t^i) - s_t^i = c_t^i \tag{2}$$

$$(1 + r_{t+1})s_t^i - \Phi(s_t^i r_{t+1}) + P(w_t^i l_t^i) = c_{2t+1}^i \tag{3}$$

where $i = 1$ for the low-ability type and $i = 2$ for the high-ability type. In equations (2) and (3), w is the wage rate, s savings, r the interest rate, $T(\cdot)$ the labor income tax function, $\Phi(\cdot)$ the capital income tax function and $P(\cdot)$ the old age pension benefit formula. We can interpret $P(w_t^i, l_t^i)$ as the pension benefit per individual of type i in period $t + 1$. The disabled individuals are denoted by $i = 0$, and we assume that the disabled do not work. The budget constraint of a disabled individual is given by

$$b_t - s_t^0 = c_{1t}^0 \tag{4}$$

$$(1 + r_{t+1})s_t^i - \Phi(s_t^0 r_{t+1}) + P(b_t) = c_{2t+1}^0 \tag{5}$$

where b is the disability benefit. For the generation born in period t, the private decision variables are s_t^0, l_t^1, s_t^1, l_t^2 and s_t^2.

The production side of the economy consists of identical competitive firms producing a homogenous good. Given these characteristics, the number of firms is not important and will be normalized to one. The production function is given by $f(N_t^1 l_t^1, N_t^2 l_t^2, K_t)$, where N_t^i is the number of young individuals of type i in period t, whereas K_t is the aggregate capital stock. By using the first order conditions, we can derive equilibrium expressions for the wage rates and the interest rate. For later use, the wage ratio (or relative wage rate) will be defined as $\phi_t = w_t^1/w_t^2 = \phi(l_t^1, l_t^2, K_t)$. The capital market equilibrium condition is given by $N_t^0 s_t^0 + N_t^1 s_t^1 + N_t^2 s_t^2 = K_{t+1}$.

We are now in the position to formulate the optimal tax and expenditure problem. In accordance with Pirttilä and Tuomala (2001), we assume that the government maximizes a general social welfare function, in which the welfare of each type belonging to the same generation enters additively

$$W = W(N_0^0 U_0^0 + N_0^1 U_0^1 + N_0^2 U_0^2, ...) \tag{6}$$

subject to self-selection constraints and a resource constraint. There are two types of self-selection constraints. First, by assuming that redistribution among the employed aims at redistributing from high income earners to low income earners, we do not want the employed high-ability type to mimic the employed low-ability type. This means that one of the self-selection constraints becomes

$$U_t^2 = U(c_{1t}^2, z_t^2, c_{2t+1}^2; \beta) \geq U(c_{1t}^1, H - \phi_t l_t^1, c_{2t+1}^1; \beta) = \hat{U}_t^2 \tag{7}$$

for all t, where $\hat{U}$ is used to denote that a working high-ability type mimics the working low-ability type, and $\beta = \beta^1 = \beta^2$. The remaining self-selection constraint serves to prevent the employed low-ability type from mimicking the disabled, implying that[1]

$$U_t^1 = U(c_{1t}^1, z_t^1, c_{2t+1}^1; \beta) \geq U(c_{1t}^0, H, c_{2t+1}^0; \beta) = \check{U}_t^1 \tag{8}$$

[1]To simplify the analysis, we disregard the possibility of identifying the disabled by means other than the self-selection constraint on tax and expenditure policies. For analyses of tagging in combination with taxation, see Akerlof (1978) and Boadway et al. (1999).

for all t. With equations (7) and (8) at our disposal, note that an employed high-ability type would always prefer his/her own allocation than that of the disabled, meaning that no additional self-selection constraint is needed.

Turning, finally, to the resource constraint, we assume that the government balances its budget in each time period. The tax revenues consist of all pure profits (if any) as well as the revenues from the labor income tax and the capital income tax, whereas the public expenditures refer to old age pension benefits and disability pension benefits. By combining the budget constraint for the government with the individual budget constraints, we obtain the resource constraint for period t

$$f(N_t^1 l_t^1, N_t^2 l_t^2, K_t) + K_t - \sum_i N_t^i c_{1t}^i - \sum_i N_{t-1}^i c_{2t}^i - K_{t+1} = 0 \tag{9}$$

Following Pirttilä and Tuomala (2001), we assume that the government is able to credibly commit to a tax and expenditure structure, where all parts have to be chosen subject to the self-selection constraints. Let λ_t and μ_t be the Lagrange multipliers associated with the self-selection constraints given by equations (7) and (8), respectively, whereas γ_t is the Lagrange multiplier associated with the resource constraint. We begin by characterizing the efficient labor income tax structure and old age pension structure. Denote by $T'(w_t^i l_t^i)$ and $P'(w_t^i l_t^i)$ the marginal labor income tax rate and marginal pension benefit, respectively, for type i and consider Proposition 1;

Proposition 1 *Within the given framework, $T'(w^i l^i)$ and $P'(w^i l^i)$ satisfy*

$$T'(w_t^1 l_t^1) - \frac{1}{\theta_t^1} P'(w_t^1 l_t^1) = \frac{1}{w_t^1 N_t^1} \lambda_t^* [\frac{\partial U_t^1 / \partial z_t^1}{\partial U_t^1 / \partial c_{1t}^1} - (\frac{\partial \hat{U}_t^2 / \partial z_t^1}{\partial \hat{U}_t^2 / \partial c_{1t}^1})(\phi_t + \frac{\partial \phi_t}{\partial l_t^1} l_t^1)]$$

$$T'(w_t^2 l_t^2) - \frac{1}{\theta_t^2} P'(w_t^2 l_t^2) = -\frac{1}{w_t^2 N_t^2 \gamma} \lambda_t \frac{\partial \hat{U}_t^2}{\partial z_t^1} \frac{\partial \phi_t}{\partial l_t^2} l_t^1$$

where $\lambda_t^* = \lambda_t (\partial \hat{U}_t^2 / \partial c_{1t}^2)/\gamma$ and $\theta_t^i = 1 + r_{t+1}(1 - \Phi'(s_t^i r_{t+1}))$.

Proposition 1 implies that, if the capital income tax rates are optimally chosen (see below), then the present value of the marginal tax-benefit effect, $T'(w^i l^i) - (1/\theta_t^i)P'(w^i l^i)$, plays the same role as the marginal income tax rate would do in the absence of pensions[2]. The present value of the marginal tax-benefit effect is, in turn, interpretable in terms of the self-selection constraint that serves to eliminate the incentive for the working high-ability type to mimic the working low-ability type. As can be seen, the self-selection constraint affects the present value of the marginal tax-benefit effect for the working low-ability type via two channels. First, the slope of the indifference curves differs between the low-ability type and the mimicker, which typically provides an incentive to increase the present value of the marginal tax-benefit effect for the low-ability type. Second, an increase the hours of work affects the wage ratio and, therefore, the utility of the mimicker. The following result is a direct consequence of Proposition 1;

Corollary 1: *If the pension benefit formula is restricted to $P(w^i l^i) = \alpha w^i l^i$, where α is a constant, then the pension system works to increase the marginal labor income tax rates for both ability types.*

Corollary 1 is interesting primarily in the sense of highlighting a relevant special case: pension benefit formulas are often defined in terms of a replacement ratio. The intuition behind Corollary 1 is, of course, that 'effective progression' is defined in terms of the marginal tax-benefit effect. If the pension system tends to decrease the marginal tax-benefit effect, there is an incentive to adjust the labor income tax accordingly.

The capital income tax structure is characterized in Proposition 2;

[2]This is analogous to a result in the literature on income taxation and commodity taxation, meaning that the effective marginal tax rate plays the same role as the marginal income tax rate would to in the absence of commodity taxes. See e.g. Edwards et al. (1994).

Proposition 2 *Within the given framework, the capital income tax structure satisfies*

$$\begin{aligned}\Phi'(s_t^0 r_{t+1}) &= \frac{1}{N_t^0 r_{t+1}\gamma_{t+1}}[\mu_t \frac{\partial \check{U}_t^1}{\partial c_{2t+1}^0}(\frac{\partial U_t^0/\partial c_{1t}^0}{\partial U_t^0/\partial c_{2t+1}^0} - \frac{\partial \check{U}_t^1/\partial c_{1t}^1}{\partial \check{U}_t^1/\partial c_{2t+1}^1}) \\ &\quad -\lambda_{t+1}\frac{\partial \hat{U}_{t+1}^2}{\partial z_{t+1}^1}\frac{\partial \phi_{t+1}}{\partial K_{t+1}} l_{t+1}^1 N_t^0]\end{aligned}$$

$$\begin{aligned}\Phi'(s_t^1 r_{t+1}) &= \frac{1}{N_t^1 r_{t+1}\gamma_{t+1}}[\lambda_t \frac{\partial \hat{U}_t^2}{\partial c_{2t+1}^1}(\frac{\partial U_t^1/\partial c_{1t}^1}{\partial U_t^1/\partial c_{2t+1}^1} - \frac{\partial \hat{U}_t^2/\partial c_{1t}^1}{\partial \hat{U}_t^2/\partial c_{2t+1}^1}) \\ &\quad -\lambda_{t+1}\frac{\partial \hat{U}_{t+1}^2}{\partial z_{1t+1}^1}\frac{\partial \phi_{t+1}}{\partial K_{t+1}} l_{1t+1}^1 N_t^1]\end{aligned}$$

$$\Phi'(s_t^2 r_{t+1}) = -\frac{1}{r_{t+1}\gamma_{t+1}}\lambda_{t+1}\frac{\partial \hat{U}_{t+1}^2}{\partial z_{1t+1}^1}\frac{\partial \phi_{t+1}}{\partial K_{t+1}} l_{t+1}^1$$

Proposition 2 is important for two reasons. First, it provides a complement to Pirttilä and Tuomala (2001), who consider taxation of savings (not capital income) for the employed low-ability and high-ability types. Second, and more importantly, it also characterizes the marginal capital income tax rate of the disabled. Therefore, we concentrate the discussion to the first part of Proposition 2; the other two tax formulas can be interpreted in a similar way. The capital income tax formula for the disabled contains two parts, both of which are associated with the self-selection constraint. The first term on the right hand side means that the marginal capital income tax rate depends on whether the marginal rate of substitution between consumption in periods 1 and 2 facing the disabled exceeds, or falls short of, that of the mimicking low-ability type. As such, the more (less) the disabled value current consumption relative to the valuation of current consumption by the mimicker, the higher (lower) the marginal capital income tax rate facing the disabled. The second term on the right hand side implies that the marginal capital income tax rate also depends on how the capital stock in period $t+1$ (via savings in period t) influences the wage ratio. If an increase in the capital stock increases (decreases) the wage ratio, it makes mimicking less (more) attractive. This provides, in turn, an incentive for the government to increase (decrease) savings via a lower (higher) capital income tax rate. As a consequence, capital income taxation of the disabled serves, in part, as an instrument to redistribute among low and high income earners.

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