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DOES THE TAX SYSTEM ENCOURAGE TOO MUCH EDUCATION?

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JEL Classification: H21, H24.

Keywords: dual income taxation, optimal income taxation, human capital investment, consumption value of education.

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1 Introduction

Most industrial countries have reduced the progressivity of their labour income tax systems over the last 20 years. Some countries also consider shifting to a proportional labour income tax in order to enjoy efficiency gains and hopefully stimulate labour supply.

Standard optimal tax theory predicts an efficiency loss when labour income is taxed. The wage received by the employee is less then the wage paid by the employer, creating distortions in the labour market. It is generally assumed that labour income taxation reduces labour supply below the optimal level. The size of the efficiency loss increases when the marginal tax rate increases. This is often used as a stark efficiency argument in favour of reducing the marginal labour income tax. This paper suggests an efficiency argument in favour of progressive labour income taxation.

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The Scandinavian countries have a system of dual income taxation, with a proportional tax on capital income and a progressive tax on labour income. Nielsen and Sørensen (1997) argue that this asymmetric treatment of the two types of income can be defended on pure efficiency grounds. The progressivity of the labour income tax serves to reduce the private return to human capital investment, thereby offsetting the tendency of a proportional comprehensive income tax to discriminate in favour of such investments. They use a simple overlapping generation model of a small open economy. The consumer faces a trade-off between investments in financial and human capital. He seeks to maximise his life time consumption, and education is only a means to shift consumption between periods. The cost of getting education is foregone labour income.

If the individual faces a choice between investing in real or human capital, the tax system creates another distortion. Depreciation of real capital is tax deductible, whereas the depreciation of the human capital to zero at death is not. Nerlove et al. (1993) investigate this effect on the accumulation of real versus human capital in society. They find, in contrast to Nielsen and Sørensen, that comprehensive proportional income taxation will discriminate against human capital investments. But these differing conclutions are caused by different underlying assumptions in the two papers.

Often the individual faces more costs than the time spent on education. Most of these costs, as e.g. tuition and books, are not reduced by a labour income tax. Hence the total costs of education will be reduced less by an income tax than the return to education. As shown by Heckman (1976), this will have a negative effect on the accumulation of human capital.

The possibility to substitute leisure for labour introduces a new distortion caused by the income tax. Labour income taxation causes a decrease in the price of leisure. The substitution effect of this leads the individual to choose less education than he would under a system of lump sum taxation. Altogether the individual prefers less education.

In all of these models, the only reason for the individual to get education, is higher expected wages. The Nordic countries, and especially Norway, have small wage differentials. In spite of a rapid growth in the demand for educated labour, the wage returns to most kinds of education have not increased correspondingly. Gottschalk (1997) finds that in the U.S. the return to a college degree compared to having only high school was 31% in 1973, while in 1993 it had risen to 53%. According to Hægeland et al. (1999) the return to education in Norway has been more or less stable during the years between 1980 and 1990. Also, Moen and Semmingsen (1996) find that several kinds of higher education have negative lifetime income in Norway, compared with having only high school. In spite of this modest wage return to education, Norway has among the highest educational levels in the OECD. Hence there has to be other and possibly more important motives besides higher expected wages behind the individual's decision to invest in human capital.

Additional motivation for getting an education is the possibility to enjoy the life as a student, to learn new things, and to pursue own interests. Education increases the chances of getting an interesting job. Flexibility between jobs increases through education, and chances are that if he becomes unemployed, the individual can more easily find a new job. Bishop (1994) found that for most of the OECD-area the larger part of the unemployed in the 1980s had no higher education. The social status connected with higher education is a factor which is not insignificant for the

educational decisions. We cannot rule out that expectations and norms in society have an influence on whether or not the young person chooses to get education. In fact, Hægeland et al. (1999) find that the parental educational level has a positive influence on the length of the education their children choose to get.

All of these non-wage related motives behind the educational choice I summarise as the intrinsic value of education. Education may be viewed as consumption good, for which the individual is willing to pay. He accepts a lower wage return to the investment in human capital in order to receive the consumption value of the education. In this case the intrinsic value of education is positive. It is also possible that individuals consider education as a consumption bad. The individual then has to be compensated for his disutility of education in order to invest in human capital, and the intrinsic value of education is negative.

Lazear (1977) uses data from young men in the US in the period of 1966-1969, and he finds that education in fact is a consumption bad. People acquire education below the optimal level, and they are willing to forego wealth in order to avoid the consumption of education. High school is here defined as higher education. Lazear also finds that at least for individuals with higher levels of education (MA's and PhD's) schooling is considered a good. He does not include taxes in his model.

Heckman, Lochner, and Taber (1998) mention in a verbal analysis that income tax may have an effect on human capital formation. They argue that proportional taxation no longer is neutral when nonpecuniary costs or benefits are present. If the net financial benefit before taxes is positive, an increased tax rate reduces the investment in human capital. This effect is even stronger with a progressive income tax.

Judd (1999) claims that he allows education to have a consumption value in his optimal tax analysis. But the only general case he analyses is where education is an intermediate good and holds no consumption value. Using a specific utility function he finds that if education is a good, it is optimal with a flat tax on labour income and no tax on human capital holdings. If, on the other hand, education is a consumption bad, it is optimal with a positive tax on human capital holdings.But these results are sensitive to the choice of an isoelalstic separable utility function. Judd criticises the present capital income tax literature for lack of economic intuition, but he often fails to give the economic intuition behind his own results. Several times he switches between denoting the tax τ_H as tax on human capital formation and tax on human capital holdings. The process of human capital formation is not described, neither is the difficulty of levying a tax on human capital holdings. How does one measure an individual's human capital? Because of differing innate ability, various individuals acquire different levels of human capital, even if they get the same education.

Judd (1998) argues that education is a consumption bad. Observations in the U.S. give the impression that human capital has a higher mean return than comparable financial assets. The argument is that individuals have to be compensated for the negative consumption value of education in order to be willing to invest in human capital. This might be true for the U.S., but in Scandinavia wage return to education is modest. Some kinds of education even have a negative wage return in Norway. Individuals choose to invest in human capital at a lower return than

comparable financial assets, and hence education may be viewed as a consumption good. In the following education is assumed to be a consumption good with a positive intrinsic value.

The present paper expands the model of Nielsen and Sørensen (1997) by including the intrinsic value of education as a motivation behind the educational decision. The objectives are to investigate the consequences for the optimal tax profile, and to see if progressive labour income taxation still is defendable on efficiency grounds. Education is no longer just an investment object and a means for shifting consumption between periods; it bears a direct consumption value for the individual.

I study optimal taxes in two cases: first in the pure consumption model of Nielsen and Sørensen, and then in the expanded model with intrinsic value of education. Section 2 presents the general framework and analyses consumer behaviour in the two models. In section 3 the optimal tax analysis is carried out for both cases, and the results are compared. Section 4 summarises the results.

2 The Models

2.1 General Assumptions behind the Models

A representative consumer lives for two periods, 1 and 2. Let T_1 and T_2 be the length of the periods, which need not be equal. The individual devotes a fixed number of hours, $\overline{L}_i$, to leisure in each period. In the second period, the remaining time is spent working, whereas he may spend some of the time getting an education in the first period. The time budget constraints are

$$\begin{aligned} \text{Period 1} \quad &: \qquad T_1 = H_1 + E + \overline{L}_1, \\ \text{Period 2} \quad &: \qquad T_2 = H_2 + \overline{L}_2, \end{aligned}$$

with H_i denoting the time he spends working in each period i. E is the time spent on education. Individuals leave no bequests and there are no government transfers. Thus, labour is the only source of income. Let w be the real wage, i.e. the basic wage for all workers. t_l [1] is the labour income tax for unskilled labour. First period consumption is given by

$$C_1 = w(1 - t_l)(T_1 - E - \overline{L}_1) - S, \tag{1}$$

with S being savings made in the first period. r is the real interest rate paid on assets held from period 1 to period 2. Savings may be positive or negative, and we assume that there are no liquidity constraints.

Education is another kind of savings. If an individual gets education in the first period, his wage in the second period increases by $g(E)$. $g(E)$ is the function representing the return to education, assumed to be increasing and concave in E:

[1] This is the lowest tax rate in a progressive tax system, and it is what Nielsen and Sørensen call t_1. The subscripts 1 and 2 denominate the two periods of time, and to avoid confusion, we let the subscripts l and h denominate the low and high tax rates.

$g' > 0, \qquad g'' < 0.$

I.e. the more time he spends on education, the higher will his wage in the next period be. We also assume

$g(E) > 1, \qquad g(0) = 1,$

implying that the individual always gains from getting education. This rules out the possibility that an unskilled worker may get better paid than a skilled worker. The cost of education is foregone labour income in the first period. The consumer does not face any direct costs of education. To be able to analyse the effects of progressive taxation, we introduce a proportional tax t_h on the additional wage $[g(E) - 1]$ that the consumer receives in the second period, if he spent some time getting education in the first period. We have a progressive labour income tax if $t_l < t_h$, and a proportional income tax if $t_l = t_h$. Capital income, r, faces the proportional, exogenously given tax rate τ.

We use period one consumption as numeraire, and set its price to be one. Period 2 consumption is

$$C_2 = [1 + (1 - \tau)r]S + (1 - t_l)w(T_2 - \overline{L}_2) + (1 - t_h)w[g(E) - 1](T_2 - \overline{L}_2). \tag{2}$$

Combining (1) and (2) gives the lifetime budget constraint:

$$\begin{aligned} C_1 + pC_2 &= w_l[T_1 - E - \overline{L}_1 + p(T_2 - \overline{L}_2)] + pw_h[g(E) - 1](T_2 - \overline{L}_2) \\ &= w_l(H_1 + p\overline{H}_2) + pw_h[g(E) - 1]\overline{H}_2. \end{aligned} \tag{3}$$

By introducing a new notation, we can simplify the representation of consumer behaviour both in he the case with and without taxes. Define

$$w_l = (1 - t_l)w, \tag{4}$$

which is the marginal after tax real wage for unskilled labour (the net basic wage). The marginal after tax real wage for skilled labour is defined as

$$w_h = (1 - t_h)w. \tag{5}$$

Then the net wage return to education is equal to $w_h[g(E) - 1]\overline{H}_2$.
The relative price of period 2 consumption measured in units of consumption in period 1 is defined as

$$p \equiv \frac{1}{1 + (1 - \tau)r}. \tag{6}$$

Note that for $\tau > 0$, we have

$$p > \frac{1}{1 + r},$$

implying that the capital income tax makes future consumption more expensive. I.e. the consumer must give up more consumption in period 1 to achieve a given level of consumption in period 2. This is if he uses the financial market to shift consumption between periods.

I will now investigate how the consumer's preferences matter in his reaction to different tax levels. To do this, I specify his utility function in two different ways; in the first he only gets utility from consumption. This is the specification used by Nielsen and Sørensen[2]. In the second, education has an intrinsic value and is therefore included in the utility function.

2.2 Model i) - The pure consumption model.

Let the utility function of a representative consumer be

$$U = U(C_1, C_2), \qquad U_1 > 0, \quad U_2 > 0.$$

I.e. utility depends on consumption only. U_1 and U_2 denote the marginal utility of consumption in period 1 and period 2, respectively. The consumer's maximisation problem is

$$\max_{C_1, C_2, E} U(C_1, C_2) \quad \text{s.t. the budget constraint (3).}$$

The first order conditions for an interior optimum are:

$$U_1 - \lambda = 0, \tag{7}$$

$$U_2 - p\lambda = 0, \tag{8}$$

$$-w_l + pw_h g'(E)\overline{H}_2 = 0. \tag{9}$$

λ is the marginal utility of money, assumed strictly positive. (7) and (8) state the usual first order conditions; that the marginal utilities of consumption equal the marginal costs. Rearranging (9) gives

$$w_l = pw_h g'(E)\overline{H}_2. \tag{10}$$

The marginal cost of getting education equals the discounted marginal gain. The marginal gain is the present value of the additional income he gets in period 2 by choosing to get one more unit of education in period 1.

From (9) we get the optimal investment condition:

$$(1-\tau)r = \frac{(1-t_h)}{(1-t_l)} g'(E)\overline{H}_2 - 1. \tag{11}$$

[2]My conditions may differ slightly from the ones of Nielsen and Sørensen. The reason for this is that they normalised time endowment to 1 in each period, whereas I have chosen not to.

Condition (11) states that in optimum the net marginal rate of return on financial capital investments (the left hand side of(11)) is equal to the net marginal rate of return on human capital investments (the right hand side of (11)). Private returns to the two types of investments differ from their social returns. The social return to investments in financial capital is the real interest rate, r, whereas the private return to these investments is the after tax interest rate, $(1-\tau)r$. Investments in human capital give a social return of $g'(E)\overline{H}_2 - 1$, but the private return is reduced by the labour income taxes. If there are no taxes, equation (11) reduces to

$$r = g'(E)\overline{H}_2 - 1 \tag{12}$$

In this case, the consumer invests in financial and human capital until the social returns on the margin are equal. Here no distortions exist, and so private and social returns are identical. The income taxes create distortions since the social return on the investment differs from the return that the consumer faces when he makes his investment decisions.

Combined with the budget constraint, the first order conditions give us the demand functions:

$$C_1 = C_1(w_l, w_h, p), \qquad C_2 = C_2(w_l, w_h, p), \qquad E = E(w_l, w_h, p).$$

The indirect utility function is found by substituting these demand functions into the utility function:

$$V(w_l, w_h, p) \equiv U(C_1(w_l, w_h, p), C_2(w_l, w_h, p)).$$

Using the envelope theorem, we find the first order derivatives of this function:

$$\begin{aligned} \frac{\partial V}{\partial w_l} &= \lambda(H_1 + p\overline{H}_2), \\ \frac{\partial V}{\partial w_h} &= \lambda p[g(E) - 1]\overline{H}_2. \end{aligned} \tag{13}$$

These expressions will be useful later on.

2.3 Model ii) - Consumption value of education.

Higher future wages is not the only reason why the consumer chooses to get an education. E.g. the fact that education enables him to get an interesting and challenging job is important. I summarise the other factors behind the educational decision as the intrinsic value of education. The way I model this, is to include education in the individual's utility function.

Let the utility function be

$$U = U(C_1, C_2, E), \qquad U_1 > 0, \quad U_2 > 0, \quad U_E > 0.$$

U_E is the marginal utility of education, and it represents the intrinsic value of education. Education now has a kind of consumption value, and we will investigate how this influences the consumer's investment decisions.

The maximisation problem of a representative individual now becomes

$$\max_{C_1,C_2,E} U(C_1, C_2, E) \quad \text{s.t. the budget constraint (3).}$$

The first order conditions for an interior optimum are:

$$\begin{aligned} U_1 - \lambda &= 0, && (14)\\ U_2 - p\lambda &= 0, && (15)\\ U_E - \lambda[w_l - pw_h g'(E)\overline{H}_2] &= 0. && (16) \end{aligned}$$

Manipulating (16) gives the condition for optimal investment behaviour:

$$(1-\tau)r = \frac{1}{1 - \frac{U_E}{(1-t_l)w\lambda}} \left(\frac{(1-t_h)}{(1-t_l)} g'(E)\overline{H}_2 \right) - 1. \qquad (17)$$

The individual invests in financial and human capital until the marginal return is equal in the two investment alternatives. Compared with the optimal investment condition in the pure consumption model (equation (11)), we have an additional fraction on the right hand side.

$$0 > \frac{U_E}{(1-t_l)w\lambda} > 1$$

is the consumer's marginal consumption value of education, measured in net labour income. From the assumtion of postive consumtption value of education it follows that this fraction is positive. It is also smaller than one, which can be shown by investigating (16).Hence, in optimum, the private return to financial investments is higher than the net marginal wage return to human capital investments:

$$(1-\tau)r > \left(\frac{(1-t_h)}{(1-t_l)} g'(E)\overline{H}_2 \right) - 1.$$

The additional consumption value of education induces the consumer to invest in human capital at a lower wage return than in the pure consumption model. If the consumer is to reduce his educational level, he must be compensated for the direct utility reduction. This means that the interest rate now must be higher to make the consumer give up one unit of human capital and invest in one extra unit of financial capital instead. The consequences for the optimal tax profile are important, and they will be treated thoroughly in section 3.2.

Combined with the budget constraint, the first order conditions give us the demand functions:

$$C_1 = C_1(w_l, w_h, p), \qquad C_2 = C_2(w_l, w_h, p), \qquad E = E(w_l, w_h, p).$$

The indirect utility function is found by substituting these demand functions into the utility function:

$$V(w_l, w_h, p) \equiv U(C_1(w_l, w_h, p), C_2(w_l, w_h, p), E(w_l, w_h, p)).$$

Using the envelope theorem, we find the first order derivatives of the indirect utility function;

$$\begin{aligned} \frac{\partial V}{\partial w_l} &= \lambda(H_1 + p\overline{H}_2), \\ \frac{\partial V}{\partial w_h} &= \lambda p[g(E) - 1]\overline{H}_2. \end{aligned} \tag{18}$$

These are needed for the optimal tax analysis.

2.4 The production sector.

The domestic sector produces one good, which is a perfect substitute for the foreign good. The price of the foreign good is exogenously given and normalised to 1. Hence the price of the domestic good also has to be 1. The industry has a standard neoclassical production function of the form

$$Z = F(K, N),$$

where Z is the amount produced, K is the total amount of capital in the industry, and N is total effective labour input. The production function is linear and homogenous of degree one, so that

$$Z = Nf(k), \qquad \text{with } k = \frac{K}{N}.$$

In steady-state, when work effort is constant over time, the total effective labour input is given by

$$N = (T_1 - E - \overline{L}_1) + g(\overline{E})(T_2 - \overline{L}_2).$$

At each point in time there are two generations living in the economy. $(T_1 - E - \overline{L}_1)$ is the work effort of the young generation, who also invests in education during the period. The old generation offers $g(\overline{E})(T_2 - \overline{L}_2)$ effective units of labour.

The industry demands of capital and labour are given by

$$f'(k) = r, \qquad f(k) - rk = w,$$

with k being the capital intensity in the industry (capital per unit effective labour input), and w the real wage per unit of effective labour. From this we see that domestic capital intensity and the real wage are given by the international interest rate, implying that domestic pre tax factor prices remain unaffected by changes in the domestic tax rates. Therefore saving and labour supply will only need one period to fully adapt to new tax rates.

2.5 The public sector.

The public sector offers goods and services, and it has a fixed level of expenditure. Public expenditure is financed through an exogenously given tax on financial income (τ), a labour income tax (t), and by issuing debts (D). The government wishes to carry through a tax reform to introduce Pareto-efficient labour income tax rates. Tax rates are chosen so as to maximise the welfare of the current young generation and all future generations, without reducing the welfare of the current old generation. To give all generations the same utility gain from the reform, the government must adjust its burden of debt and keep this new level of debt constant through all future periods. In each period there are two generations, from which the government receives taxes. With the superscript "0" denoting pre reform variables, the government budget constraint for the reform period becomes

$$t_l^0 w\overline{H}_2 + t_h^0 w[g(\overline{E}^0) - 1]\overline{H}_2 + \tau r S^0 + t_l w(T_1 - E - \overline{L}_1) + D = G, \tag{19}$$

where $p = p^0$, $D^0 = 0$, and $S^0 = (1 - t_l^0)w\overline{H}_1^0 - C_1^0$.

In the next period, all living individuals have fully adapted to the new tax rates. The government may therefore, without problems, tax everybody according to the new Pareto-optimal tax rates. In this period, the governmental budget constraint is

$$t_l w(T_1 - E - \overline{L}_1) + t_l w\overline{H}_2 + t_h w[g(\overline{E}) - 1]\overline{H}_2 + \tau r\overline{S} = G + rD, \tag{20}$$

where $\overline{S} = (1 - t_l)w(T_1 - \overline{E} - \overline{L}_1) - \overline{C}_1$ is the savings of the old generation in the previous period.

By substituting for D from (19) into (20) and manipulating, we find the public budget constraint:

$$(1 + r)(w - w_l)H_1 + (w_h - w_l)\overline{H}_2 + (w - w_h)g(E)\overline{H}_2 + \tau r(w_l H_1 - C_1) - (1 + r)G + rR = 0, \tag{21}$$

where $R = t_l^0 w\overline{H}_2 + t_h^0 w[g(\overline{E}^0) - 1]\overline{H}_2 + \tau r S^0$ is a constant.

3 Optimal tax analysis.

Taxes on labour income, t_l and t_h, are chosen so as to maximise the welfare of the representative consumer at the least efficiency loss. The tax on capital income, τ, is exogenously given. We look at two different cases. First, when we have no tax on capital income, $\tau = 0$, what are the optimal tax rates on labour income? Second, we have tax on capital income, $\tau > 0$, and political reasons make it impossible to change this.In the real world, individuals get income from different sources, some mostly from labour and others mostly from return to capital investments. Taxing only labour income could then have severe distributional effects and would not be tolerated by the majority of voters. What are the optimal tax rates on labour income that minimise the efficiency loss in this case?

These analysises are conducted in both models, with and without consumption value of education. The purpose is to investigate whether the optimal tax rates change with the introduction of education as a consumption good. Analytically, we maximise the consumer's indirect utility function with respect to the net wages w_l and w_h subject to the public budget constraint.

3.1 Optimal taxes in model i) - The pure consumption model.

The governmental maximisation problem now is

$$\max_{w_l, w_h} V(w_l, w_h, p) \quad \text{s.t. the public budget constraint (21)}$$

From the corresponding Lagrangian-function, we find the first order conditions:

$$\frac{\partial V}{\partial w_l} + \mu \left\{ \begin{array}{c} -\overline{H}_2 - (1+r)H_1 + (1+r)(w-w_l)\frac{\partial H_1}{\partial E}\frac{\partial E}{\partial w_l} \\ +(w-w_h)\overline{H}_2 g'(E)\frac{\partial E}{\partial w_l} + \tau r w_l \frac{\partial H_1}{\partial E}\frac{\partial E}{\partial w_l} + \tau r H_1 - \tau r \frac{\partial C_1}{\partial w_l} \end{array} \right\} = 0, \tag{22}$$

$$\frac{\partial V}{\partial w_h} + \mu \left\{ \begin{array}{c} \overline{H}_2 + (1+r)(w-w_l)\frac{\partial H_1}{\partial E}\frac{\partial E}{\partial w_h} - g(E)\overline{H}_2 \\ +(w-w_h)\overline{H}_2 g'(E)\frac{\partial E}{\partial w_h} + \tau r w_l \frac{\partial H_1}{\partial E}\frac{\partial E}{\partial w_h} - \tau r \frac{\partial C_1}{\partial w_h} \end{array} \right\} = 0. \tag{23}$$

Tedious manipulations, using equations (13), (22), and (23), give the condition for optimal tax policy:

$$\frac{1-t_l}{1-t_h} - \frac{1+r}{1+(1-\tau)r} = 0 \tag{24}$$

With no tax on capital income, $\tau = 0$, the Pareto-optimal labour income tax rates are given by $t_l = t_h$, i.e. a proportional labour income tax. A proportional labour income tax does not influence the investment decision of the consumer. It is thus a neutral tax on human capital investments. Combined with zero taxation of financial income, the social return on both kinds of investments equal the private return. This is the first-best solution, and the tax does not create any distortions in the capital market. Since leisure is fixed in both periods, labour supply is fixed in the second period, and education is a pure investment, no subsitution effect arises from taxing labour income Then the proportional tax on labour income combined with zero tax on capital income is equivalent with a pure consumption tax.

If there exists an exogenously given positive tax on financial income, $\tau > 0$, the optimal labour income tax rates are given by $t_l < t_h$, so that we have a progressive labour income tax[3]. The

[3]Given that the public expenditure is constant, one might expect that the additional tax revenue from taxing capital income migh remove the need of taxing labour income. But in order to minimise the distortions in the investment market caused by the taxes, it is optimal with a progressive tax on labour income. The level of the opitmal tax rates might change with the presence of tax on capital income, but this is not treated in this analysis. It is an open question though, if tax revenue really increases that much from taxing capital income.While getting education, the consumer has a possibility to finance his first period consumption with negative saving. The interest payments in the second period are then tax deductible, and tax revenue decreases.

progressive labour income tax reduces the wage return to human capital investments, and thereby reduces some of the distortions that would arise with a proportional labour income tax.
If both the labour income tax and the tax on capital income are proportional, $t_l = t_h$ and $\tau > 0$, the optimal investment condition (11) reduces to

$$(1-\tau)r = g'(E)\overline{H}_2 - 1. \tag{25}$$

Here we have no actual taxation of the returns to human capital investments. This is because the return to the investment faces the same tax rate as the cost, measured in foregone labour income in the first period[4]. Return to financial investments on the other hand, faces a positive tax rate τ. This causes a distortion in the investment market in favour of human capital. We see from the above equation that the consumer will invest in human capital at a lower rate of return than in the case with no taxes. Since education has a diminishing rate of return, this means that he invests more in human capital than he would have done if there were no taxes. This overinvestment in human capital is counteracted by a progressive labour income tax, reducing the return to education.

The second-best literature states that if a tax created distortion exists in one market, then trying to achieve efficiency in the other markets is not necessarily optimal. But Diamond and Mirrlees (1971) show that it is desirable with aggregated production efficiency even though taxation leads to distortions in one market. Rewriting the optimal tax condition (24) and denoting $(1-\tau)r = r_\tau$ yields

$$\frac{1-t_l}{1-t_h} = \frac{1+r}{1+r_\tau}. \tag{26}$$

Substituting $\frac{1-t_l}{1-t_h}$ in the optimal investment condition (11) with (26) gives us the following:

$$r = g'(E)\overline{H}_2 - 1. \tag{27}$$

This corresponds to the production efficiency result of Diamond and Mirrlees. The marginal return on investments in financial capital equals the marginal return on investments in human capital, and production efficiency is achieved even in the presence of taxation. It is essential to this result that the equality of (26) holds. From this equation we see that in the case of no tax on capital income, $r_\tau = r$, we need proportional tax on labour income, $t_l = t_h$, in order to achieve efficiency in the investment market. But if there for some reason exists an exogenously given tax on capital income, so that $r_\tau < r$, then a progressive tax, $t_l < t_h$, has to be levied on labour income in order to achieve production efficiency.

The next step is to investigate the optimal tax rates in the situation where education no longer is a pure investment, but where it holds a direct consumption value for the consumer.

[4]Sandmo (1979) shows the neutrality of a cash flow tax.

3.2 Optimal taxes in model ii) - with intrinsic value of education.

The government's maximisation problem is

$$\max_{w_l, w_h} V(w_l, w_h, p) \quad \text{s.t. the public budget constraint (21)}$$

The first order conditions in this case are the same as conditions (22) and (23) of model i). Inserting equation (18) into the first order conditions and manipulating, we find the condition for optimal tax rates when education has an intrinsic value;

$$\frac{U_E}{w\lambda}\left(\frac{\tau r}{1+(1-\tau)r}\frac{\partial C_1}{\partial Y} - \frac{t_h}{1-t_h}\right) + \left(\frac{1-t_l}{1-t_h} - \frac{1+r}{1+(1-\tau)r}\right) = 0, \tag{28}$$

where $\frac{\partial C_1}{\partial Y}$ is the marginal propensity to consume in the first period.

In the case of no tax on capital income, $\tau = 0$, equation (28) reduces to:

$$-\frac{t_h}{1-t_h}\frac{U_E}{w\lambda} + \frac{1-t_l}{1-t_h} - 1 = 0.$$

I.e.[5]

$$t_h > t_l.$$

Contrary to the corresponding results in model i), we find that *even with no taxation of capital income, it is optimal with progressive labour income taxation.* The intuition behind this can be understood by considering the consumer's optimal investment condition, equation (17):

$$(1-\tau)r = \frac{1}{1 - \frac{U_E}{(1-t_l)w\lambda}}\left(\frac{1-t_h}{1-t_l}g'(E)\overline{H}_2\right) - 1.$$

Due to the additional direct utility return to education, a proportional labour income tax is no longer neutral; it discriminates between the two investment alternatives in favour of human capital investments. To see this clearly, let $\tau = 0$, and $t_h = t_l > 0$ in equation (17), and compare this with the situation with no taxes at all, $\tau = t_h = t_l = 0$. In the first case the consumer's marginal consumption value of education is larger than in the second:

$$\frac{U_E}{(1-t_l)w\lambda} > \frac{U_E}{w\lambda}.$$

I.e.

$$\frac{1}{1 - \frac{U_E}{(1-t_l)w\lambda}} > \frac{1}{1 - \frac{U_E}{w\lambda}}.$$

[5]

$$-\frac{t_h}{1-t_h}\frac{U_E}{w\lambda} + \frac{1-t_l}{1-t_h} - 1 = 0 \Longrightarrow (1-t_l) - (1-t_h) = t_h\frac{U_E}{w\lambda} > 0 \implies t_h > t_l$$

In both cases, the right hand side of (17) must equal the real interest rate r. Hence the marginal return to education has to vary, in order for the equality to hold:

$$[g'(E)]_{t_l>0} < [g'(E)]_{t_l=0}\,.$$

I.e.

$$[E]_{t_l>0} > [E]_{t_l=0}\,.$$

The tax on labour income creates price distortions in favour of human capital investments, and the consumer chooses to get more education than in the case with no taxes.

The reason for the distortion in favour of investments in human capital is that only the wage return to education is reduced through the income tax; the direct utility return remains unchanged. This implies that the total tax rate on return from human capital investments decreases, compared with the pure consumption model. But the alternative cost of investing in human capital, given by the net basic wage, is the same in the two cases. Put differently, a proportional labour income tax works as a tax subsidy on human capital investments, still creating distortions in the capital market. The tax makes education cheaper. Return to financial investments must be higher in the case with labour income tax in order to shift investments between financial and human capital. A progressive labour income tax reduces the wage return to education, and hence the total return. The consumer chooses to invest in financial capital at a lower interest rate than in the case with proportional labour income tax. The progressive labour income tax reduces the distortions in the capital market, and we get a solution closer to the optimum.

Next, look at the case with an already existing positive tax on capital income, $\tau > 0$. Now it is analytically more complicated to characterise the optimal tax rates on labour income. From the optimal tax condition (28), we get

$$\left(p\tau r\frac{\partial C_1}{\partial Y} - \frac{t_h}{1-t_h}\right)\frac{U_E}{w\lambda} + \frac{1-t_l}{1-t_h} = \frac{1+r}{1+(1-\tau)r}. \tag{29}$$

We know that

$$\frac{1+r}{1+(1-\tau)r} > 1,$$

implying that the left hand side of (29) is positive and greater than one. Consumption is assumed to be a normal good in both periods. The marginal propensity to consume, $\frac{\partial C_1}{\partial Y}$, is therefore between 0 and 1.A reasonable value of the marginal propensity to consume is 0,5, which will be used throughout the analysis.

The capital income tax lies within the interval

$$0 \leqslant \tau \leqslant 1.$$

We may assume that it is no larger than 0,5, since, in an open economy, capital flows out of the country if tax rates are too high. In the following analysis, we let $\tau = 0,28$, which is the tax rate on capital income in Norway.

By investigating the expression pr, we find that

$$pr = \frac{r}{1+(1-\tau)r} < 1 \qquad \text{if} \qquad r < \frac{1}{\tau} = 3,57.$$

That is, the real interest rate must be below 357%, a condition quite likely to be fulfilled. Estimating the real interest rate is difficult, since we have not specified the length of the periods. It is a good approximation to say that the annual real interest rate is 5%, summing up to 165% over a period of twenty years. (Here we include the compound interest.) Assuming that the individual only has a time span of 20 years when choosing how much to invest in human capital, the above condition is met. In the following $r = 1,65$, i.e. a real interest rate of 165%.

With these values, the first term in the brackets of equation (29) becomes

$$p\tau r\frac{\partial C_1}{\partial Y} = \frac{\tau r}{1+(1-\tau)r}\frac{\partial C_1}{\partial Y} = \frac{1,65 \cdot 0,28}{1+(1-0,28)\cdot 1,65} \cdot 0,5 = 0,106.$$

If the expression in the brackets of (29) is to be positive, the surtax t_h must not exceed a critical value. This threshold value of t_h is:

$$\frac{t_h}{1-t_h} < 0,106 \qquad \Longrightarrow \qquad t_h < 0,096.$$

I.e. t_h must not exceed 9,6%, which is substantially below the current marginal rate of income tax. Therefore the expression in brackets of (29) is negative.

We have already stated that the marginal consumption value of education measured in net labour income, $\frac{U_E}{w\lambda}$, is positive.
As long as $t_h > 0,096$, the first term on the left hand side of (29) is negative. To make the equality in (29) hold, the following must be true:

$$\frac{1-t_l}{1-t_h} = \frac{1+r}{1+(1-\tau)r} + \left(\frac{t_h}{1-t_h} - p\tau r\frac{\partial C_1}{\partial Y}\right)\frac{U_E}{w\lambda} > \frac{1+r}{1+(1-\tau)r} > 1. \tag{30}$$

I.e.

$$t_l < t_h.$$

As expected, it is optimal with progressive labour income taxation when there exists a tax on capital income. The analysis is purely qualitative, so we cannot conclude about the optimal degree of progressivity. Intuitively, labour income taxation should be more progressive when capital income is taxed, than when it is not.

$$(t_h - t_l)_{\tau=0} < (t_h - t_l)_{\tau>0}.$$

This follows from the fact that the distortions in the investment market increases when tax on capital income is introduced, which favours human capital investments. From (28) we see that the surtax must be substantially higher than the basic labour income tax in order to fulfil the equation.

These results can be shown to hold for other values of the real interest rate and of the marginal propensity to consume.

Substituting for $\frac{U_E}{w\lambda(1-t_h)}$ from (16) into the optimal tax condition (28) and rearranging, yields

$$\left(p\tau r\frac{\partial C_1}{\partial Y}+1\right)\frac{U_E}{w\lambda}\frac{1}{p}=r-\left\{g'(E)\overline{H}_2-1\right\}>0,$$

i.e.

$$r>g'(E)\overline{H}_2-1, \tag{31}$$

which should be compared to equation (27) for model i). With a postitive consumption value of education, the marginal wage return on human capital investments in optimum is smaller than the marginal return on investments in the financial market. Education no longer is only a production factor, it is a consumption good as well. Thus, we do not have production efficiency in the presence of capital income taxation in this case.

4 Concluding remarks.

OECD proposes in its 1997country report for Norway that the educational profile in Norway corresponds badly with the estimated future demand for labour. They suggest that there will be a future excess of people with theoretical knowledge, and a lack of people with vocational skills. Try (2000) shows that over the last years, there has been a clear development in Norway towards a concentration on fields of study with a modest wage return. This indicates that the intrinsic value is an important factor in the educational choice. Also, over the last decades, we have seen a development towards a less progressive labour income tax. A comprehensive proportional income tax ($t_l=t_h=\tau$) could possibly increase this trend of choosing fields of study with a modest wage return. The proportional labour income tax reduces the price of education as a consumption good, and could induce the individual to consume more than in the case with no taxes. This provides an efficiency argument in favour of progressive labour income taxation.

In a world with tax on capital income, a progressive tax on labour income is the second best solution. It minimises the efficiency distortions in the capital market. When education has an intrinsic value, it can be seen as a good for which the consumer is willing to pay. The efficiency argument in favour of a progressive labour income tax is then strengthened. The consumer chooses to invest in human capital at a lower rate of return than if education was considered only as an investment. A comprehensive proportional income tax makes the consumption of education even cheaper, which from an efficiency point of view leads to further overinvestment in human capital. The need for a progressive labour income tax to correct for these distortions increases accordingly.

I have used the simplest model possible, and it is worth noting that I cannot say anything about the levels of these optimal tax rates beyond their progressivity. Neither does this analysis consider distributional issues, or possible positive external effects of education.

By generalising the wage return function to education to make the return depend on total amount of human capital in the society, we could study the external effects of education. An individual's return to education depends not only on his own choices, but also on the educational decisions of the other individuals living in the society.

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