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HIGHER EDUCATION FINANCING AND INCOME REDISTRIBUTION

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Abstract

This paper considers an optimal income tax cum higher education policy.
It shows that in the presence of an optimal income tax system higher education should be taxed rather than subsidized. Furthermore, income taxes should become less progressive when an optimal higher education policy is introduced.

JEL Classification: H21, I22.

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1. Introduction

Public subsidies to higher education are commonplace in all developed economies. Attempts to justify this phenomenon typically emphasize market failure arguments such as positive externalities from higher education, capital market imperfections preventing people from financing higher education on a loan basis, non-existing insurance markets against educational risks, and interdependent individual preferences leading to relative income concerns.[1] In the public policy debate, on the other hand, higher education subsidies are frequently defended by equity oriented arguments like promoting fairness and facilitating access to higher education for children from low income families. Yet, it is a now well-documented fact that public involvement in higher education financing constitutes redistribution from the poorer to the richer part of the population. Higher education subsidies essentially benefit people facing large-scale lifetime labor earnings opportunities as university graduates define the upper part of the labor income distribution. Moreover, children from higher income families are more likely to engage in higher education and to choose more cost intensive branches such as medicine than children from lower income families.[2]

Against the view that public higher education financing has a regressive distributional impact, it has been argued that in the presence of an income tax system which, on average, burdens high income individuals more heavily than low income individuals, university graduates are likely to pay back part or all of the received subsidies in the form of higher taxes. University graduates can be expected to pay more taxes because higher education leads to a larger endowment with human capital translating into an increase in labor earnings and, henceforth, income taxes. Furthermore, in the presence of income tax progression university graduates are likely to pay higher taxes than non-graduates even if the two groups earn identical amounts in terms of lifetime income. This is because lifetime earnings of university graduates typically emerge within a shorter period of time than those of their non-graduate counterparts, leading to higher periodical income of university

[1] See, e.g., Creedy and Francois (1990) and Wigger (2001) on positive externalities, Barham et al. (1995) on capital market imperfections, Wigger and von Weizsäcker (1998, 2000) and Garcia-Peñalosa and Wälde (2000) on non-existing insurance markets, and Lommerud (1989) on interdependent individual preferences.

[2] See Hansen and Weisbrod (1969) and Jackson and Weathersby (1975) for the US, Psacharopoulos (1986) for several developing countries, and Grüske (1994) for Germany.

graduates and, because of tax progression, to a higher lifetime tax burden.[3]

The present paper takes up the discussion of combining a redistributive or even progressive income tax system with higher education subsidies. Rather than dealing with the question of whether university graduates in fact pay back higher education subsidies, however, the paper just asks whether it is a good idea to choose such a combination. Thus, the paper does not merely emphasize the fiscal aspect but points to the incentive ramifications of a tax cum education policy. To put the central thrust of the present approach in a suggestive way, the paper asks whether it is a good idea to first strengthen incentives to acquire human capital by using public funds to subsidize higher education and then to undermine incentives to employ human capital productively by heavily burdening high labor earnings. In fact, the paper demonstrates that it is not. The paper considers a government which aims to redistribute from high productive to low productive individuals. Labor productivity can be increased by investments in higher education. When the government cannot observe labor productivity at the individual level, it has to base its redistributive policy on labor earnings and, thus, it has to implement a labor income tax system. The government can supplement the income tax policy by a subsidy to higher education. However, if the labor income tax system has been set optimally, the government should impose a negative subsidy, i.e. it should tax higher education. Moreover, in the presence of a public engagement in higher education the labor income tax system should become less progressive.[4]

The analytical framework employed in this paper is an extended version of Stiglitz' (1982) two-class self-selection model of optimal income taxation. The interplay between optimal income taxation and educational investments has also been studied by Ulph (1977), Hare and Ulph (1979), Tuomala (1990), and Boadway

[3] The role of income tax progression for the question of whether university graduates pay back higher education subsides has recently been emphasized by Sturn and Wohlfahrt (2000). Employing Austrian data these authors demonstrate that the shorter earnings period of university graduates in conjunction with income tax progression in fact leads to a substantial extra burden of university graduates.

[4] One of the referees of this paper put my attention to a paper by Hamada (1974). This author considers the optimal mix of income tax and education policies and argues that the society can almost attain a first best optimum by increasing the marginal rate of income taxation and the marginal rate of education subsidization simultaneously. Hamada's approach seems to justify combining a progressive income tax system with an educational subsidy and contradicts the result derived in the present paper. However, Hamada (1974) restricts attention to a linear income tax schedule and, most importantly, neglects an endogenous labor-leisure choice.

and Marchand (1995). All these authors, however, employ models in which all individuals can benefit to some extent from investments in education which should mainly define the case of basic education. Here, in contrast, only high-talented people are able to increase their labor productivity by educational investments which is a distinctive feature of higher education.[5]

2. The Model

Consider an economy in which labor is the only source of income. The technology is linear and transforms one unit of efficient labor into one unit of a consumption good which serves as the numeraire. Labor is supplied by two types of individuals differing with respect to educational talent. High-talented (H-type) individuals are able to increase their labor productivity by investing in higher education, whereas low-talented (L-type) individuals are not. Labor productivity of an H-type individual having spent e_H currency units for higher education is given by $z_H = z(e_H)$, where the function z satisfies $z' > 0$, $z'' < 0$, and $z'(0) = \infty$. In contrast, labor productivity of an L-type individual is constant and given by z_L with $0 < z_L \leq z(0)$. Thus, L-types are less productive than H-types.

All individuals have identical preferences defined over consumption and labor supply. Utility of an i-type individual is given by $u_i = u(c_i - h_i)$, $i = H, L$, where the utility function u satisfies $u' > 0$ and $u'' < 0$, c_i denotes the amount of consumption of an i-type individual, and $h_i = h(l_i)$ measures the disutility of labor l_i in currency units, with $h \geq 0$, $h' > 0$, $h'' > 0$, and $h'(0) = 0$.[6]

Consumption of an L-type individual is determined by $c_L = (1-\tau_L)\, l_L\, z_L - t_L$, where τ_L and t_L are the marginal tax rate on labor income and a lump-sum tax

[5] There is a somewhat different approach on education and income redistribution by Boadway, Marceau and Marchand (1996) which emphasizes time inconsistency as an argument for education subsidies. This paper, however, abstracts from an endogenous labor-leisure choice so that high productive individuals cannot hide their high productivity behind an extensive leisure demand.

[6] The utility function employed here rules out income effects of taxation on labor supply. Assuming a more general utility function of the form $u = u(c, l)$ would not alter the results as long as it is assumed that both consumption and leisure are normal goods. However, it would complicate the algebra in a rather irrelevant respect.

imposed on L-types. An L-type individual maximizes:

$$u_L = u[(1-\tau_L)\, l_L\, z_L - t_L - h(l_L)],$$

with respect to l_L. The first-order condition reads:[7]

$$(1-\tau_L)\, z_L - h'_L = 0,$$

implying:

$$\frac{\partial l_L}{\partial t_L} = 0,$$

$$\frac{\partial l_L}{\partial \tau_L} = -\frac{z_L}{h''_L} < 0.$$

Thus, lump-sum taxation does not affect labor supply (as there are no income effects of taxation on labor supply), whereas an increase in the marginal tax rate on labor income reduces labor supply. Substituting optimal labor supply of an L-type individual into u_L, one gets the indirect utility function of L-types:

$$v_L = v_L(t_L, \tau_L),$$

with

$$\frac{\partial v_L}{\partial t_L} = -u'_L,$$

$$\frac{\partial v_L}{\partial \tau_L} = -l_L\, z_L\, u'_L.$$

Since H-types may invest in higher education, consumption of an H-type individual is constrained by $c_H = (1-\tau_H)\, l_H\, z_H - t_H - (1-\sigma)\, e_H$, where τ_H and t_H are the marginal tax rate on labor income and a lump-sum tax imposed on H-types, and σ is a subsidy (tax if negative) on investments in higher education. On condition that the market for higher education investments works perfectly, H-type individuals choose l_H and e_H so that

$$u_H = u[(1-\tau_H)\, l_H\, z_H - t_H - (1-\sigma)\, e_H - h(l_H)]$$

[7] The assumption $h'(0) = 0$ rules out a corner solution with respect to labor supply.

takes on a maximum. The respective first-order conditions are determined by:[8]

$$(1-\tau_H)\, z_H - h'_H = 0,$$
$$(1-\tau_H)\, l_H\, z'_H - (1-\sigma) = 0.$$

Applying the implicit function rule to these conditions, straightforward algebra yields:

$$\frac{\partial l_H}{\partial t_H} = \frac{\partial e_H}{\partial t_H} = 0,$$
$$\frac{\partial l_H}{\partial \tau_H} = \frac{1}{|\mathbf{H}|}\,(1-\tau_H)\, l_H\, (z_H\, z''_H - {z'_H}^2) < 0,$$
$$\frac{\partial e_H}{\partial \tau_H} = \frac{1}{|\mathbf{H}|}\,[-h''_H\, l_H\, z'_H - (1-\tau_H)\, z_H\, z'_H] < 0,$$
$$\frac{\partial l_H}{\partial \sigma} = \frac{1}{|\mathbf{H}|}\,(1-\tau_H)\, z'_H > 0,$$
$$\frac{\partial e_H}{\partial \sigma} = \frac{1}{|\mathbf{H}|}\, h''_H > 0,$$

where $|\mathbf{H}| = -(1-\tau_H)\, l_H\, z''_H\, h''_H - [(1-\tau_H)\, z'_H]^2$ is the determinant of the Hessian matrix associated with the maximization problem of H-types implying that $|\mathbf{H}| > 0$. Lump-sum taxes do neither affect labor supply nor educational investments of H-types, an increase in the marginal tax rate on labor income negatively affects labor supply and educational investments, and an increase in the subsidy on higher education positively affects these two figures. Thus, labor income taxation and higher education subsidization both have an unambiguous impact on labor supply and higher education investments of H-types. Higher labor supply of H-types as well as higher education investments can be enforced by lowering the marginal tax rate on labor earnings and/or by increasing the subsidy on higher education. Substituting optimal labor supply and optimal investment in higher education of H-types into u_H, one obtains the indirect utility function of H-types:

$$v_H = v_L(t_H, \tau_H, \sigma),$$

[8] The assumption $z'(0) = \infty$ rules out a corner solution with respect to the amount of higher education investment.

with

$$\frac{\partial v_H}{\partial t_H} = -u'_H,$$

$$\frac{\partial v_H}{\partial \tau_H} = -l_H\, z_H\, u'_H,$$

$$\frac{\partial v_H}{\partial \sigma} = e_H\, u'_H.$$

The next section considers an optimal tax system which implies redistribution from H- to L-type individuals. If the government can neither observe individual types directly nor can it observe educational investments at the individual level, it has to base taxes on individual labor income. This gives rise to the possibility that H-type individuals may wish to mimic L-type individuals by supplying fewer labor and by investing less in higher education to reduce their tax liabilities.[9] Such a mimicking H-type individual is bound to choose an amount of labor so that its gross labor income equals gross labor income of L-types. Therefore, labor supply of a mimicking H-type is determined by $l_M\, z_M = l_L\, z_L$, where $z_M = z(e_M)$ is labor productivity of a mimicking individual having spent e_M currency units for higher education. A mimicking H-type individual maximizes:

$$u_M = u[(1-\tau_L)\, l_L\, z_L - t_L - (1-\sigma)\, e_M - h(l_M)],$$

with respect to e_M. The first-order condition of this problem reads:

$$-(1-\sigma) + h'_M\, l_M\, \frac{z'_M}{z_M} = 0.$$

The assumption $z'(0) = \infty$ guarantees that a mimicking H-type individual chooses a strictly positive amount of higher education investments, i.e. $e_M > 0$. The mimicker, thus, imitates an L-type individual with respect to labor earnings but not with respect to educational investments. It will be seen in what follows that the government can exploit this behavior to enforce truth revealing individual strategies. The mimicker's first-order condition implies:

$$\frac{\partial e_M}{\partial t_L} = 0,$$

[9] Generally, L-type individuals may also wish to mimic H-type individuals by supplying more labor. However, this possibility will not occur in the presence of the redistributive objective considered below.

$$\frac{\partial e_M}{\partial \tau_L} = -\frac{1}{D}\,(h''_M\, l_M + h'_M)\,\frac{z_L}{z_M}\,\frac{z'_M}{z_M}\,\frac{\partial l_L}{\partial \tau_L} < 0,$$

$$\frac{\partial e_M}{\partial \sigma} = -\frac{1}{D} > 0,$$

where D is the second derivative of u_M with respect to e_M; it is negative as e_M maximizes u_M. Again, lump-sum taxes have no effect on the higher education investment decision, an increase in the marginal tax rate on labor income has a negative and an increase in the subsidy rate has a positive impact on higher education investments of a mimicking H-type. Substituting e_M into u_M yields the indirect utility function of a mimicking individual:

$$v_M = v_M(t_L, \tau_L, \sigma),$$

with

$$\frac{\partial v_M}{\partial t_L} = -u'_M,$$

$$\frac{\partial v_M}{\partial \tau_L} = \left[-l_L + (1-\tau_L)\,\frac{\partial l_L}{\partial \tau_L} - \frac{\partial l_L}{\partial \tau_L}\,\frac{1}{z_M}\,h'_M\right] z_L\, u'_M,$$

$$\frac{\partial v_M}{\partial \sigma} = e_M\, u'_M.$$

3. Optimal Tax Cum Education Policy

The government is assumed to engineer an optimal tax policy based on a utilitarian objective, i.e. it seeks to maximize the sum of individual utilities. Since the utilitarian objective implies the desire to redistribute from H- to L-types, the government has to take account of a self-selection constraint, guaranteeing that H-types will prefer to reveal themselves as highly talented rather than mimicking L-types.[10] More precisely, redistribution is constrained by:

$$v_H(t_H, \tau_H, \sigma) \geq v_M(t_L, \tau_L, \sigma). \tag{1}$$

[10] Note that the government solves a non-linear income tax problem although each individual type faces a linear tax schedule. This is because marginal and average tax rates can vary across types. See Marceau and Boadway (1994) for a discussion of implementing a set of type-specific linear income tax schedules to derive an optimal non-linear income tax system.

Furthermore, in pursuing its tax policy, the government is limited by a budget constraint saying that tax revenues should meet an exogenously given revenue requirement given by r plus expenditures in the form of higher education subsidies:

$$n_H\,(\tau_H\,l_H\,z_H + t_H) + n_L(\tau_L\,l_L\,z_L + t_L) = r + n_H\,\sigma\,e_H, \tag{2}$$

where n_H and n_L are the numbers of H- and L-type individuals. Without loss of generality it is assumed that $n_H + n_L = 1$.

Initially, an optimal income tax system consisting of an optimal choice of the tax parameters t_i and τ_i is considered, taking as given the subsidy on higher education σ. Subsequently, it is analyzed which form higher education subsidization should assume in the presence of an optimal (redistributive) tax system. For a given higher education subsidy, an optimal income tax system solves:

$$\max_{\{t_i,\tau_i\}_{i=H,L}} \quad n_H\,v_H(t_H,\tau_H,\sigma) + n_L\,v_L(t_L,\tau_L)$$

subject to the self-selection constraint (1) and the budget constraint (2). The tax parameters are implicitly determined by the following first-order conditions:

$$-\,n_H\,u'_H + \lambda\,n_H - \mu\,u'_H = 0, \tag{3}$$

$$\begin{aligned} -\,n_H\,l_H\,z_H\,u'_H + \lambda\,n_H\,\Bigg(& l_H\,z_H + \tau_H\,\frac{\partial l_H}{\partial \tau_H}\,z_H + \tau_H\,l_H\,z'_H\,\frac{\partial e_H}{\partial \tau_H} \\ & -\sigma\,\frac{\partial e_H}{\partial \tau_H}\Bigg) - \mu\,l_H\,z_H\,u'_H = 0, \end{aligned} \tag{4}$$

$$-\,n_L\,u'_L + \lambda\,n_L + \mu\,u'_M = 0, \tag{5}$$

$$\begin{aligned} -\,n_l\,l_L\,z_L\,u'_L + \lambda\,n_L\,&\left(l_L\,z_L + \tau_L\,\frac{\partial l_L}{\partial \tau_L}\,z_L\right) \\ &+ \mu\,\left(l_L\,z_L - (1-\tau_L)\,\frac{\partial l_L}{\partial \tau_L}\,z_L + \frac{\partial l_L}{\partial \tau_L}\,\frac{z_L}{z_M}\,h'_M\right)\,u'_M = 0, \end{aligned} \tag{6}$$

where λ and μ are Lagrange-multipliers associated with the government budget constraint and the self-selection constraint, respectively. Note that μ is strictly positive, i.e. the self-selection constraint strictly binds in the optimum.[11]

For $\sigma = 0$, i.e. in the absence of a public engagement in higher education, equations (1) to (6) define the standard non-linear optimal income tax system characterized by a positive marginal tax rate on L-types ($\tau_L > 0$) and a zero marginal tax rate on H-types ($\tau_H = 0$). Here, this will not be analyzed in detail as it is well-known from the optimal tax literature [see Stiglitz (1982)]. Instead, it will be asked how the government should engage in higher education if the income tax system has been set optimally. For this purpose substitute the tax parameters as defined by the first-order conditions (3) to (6) and the constraints (1) and (2) into the government's objective function. This yields a maximum value function of the form $\Omega = \Omega(\sigma)$. It measures the value of social welfare attained from a given level of higher education subsidization if the optimal tax system is implemented. Applying the Envelope theorem, it follows that:

$$\begin{aligned} \frac{d\Omega}{d\sigma} =& n_H\, e_H\, u'_H + \lambda\, n_H \left(\tau_H \frac{\partial l_H}{\partial \sigma} z_H + \tau_H\, l_H\, z'_H \frac{\partial e_H}{\partial \sigma} \right. \\ & \left. - e_H - \sigma \frac{\partial e_H}{\partial \sigma} \right) + \mu\, (e_H\, u'_H - e_M\, u'_M). \end{aligned} \tag{7}$$

Multiplying (3) by e_H and adding the result to (7), the latter reduces to:

$$\frac{d\Omega}{d\sigma} = \lambda\, n_H \left(\tau_H \frac{\partial l_H}{\partial \sigma} z_H + \tau_H\, l_H\, z'_H \frac{\partial e_H}{\partial \sigma} - \sigma \frac{\partial e_H}{\partial \sigma} \right) - \mu\, e_M\, u'_M. \tag{8}$$

Equation (8) reveals that the change in social welfare due to a marginal increase in the subsidy on higher education can be decomposed in a fiscal and an incentive effect. The fiscal effect is given by the first summand on the right hand side of (8). An increase in σ will lead to higher labor earnings of H-types. This is because it affects an increase in their labor supply as well as an increase in their labor productivity since they devote more currency units to higher education. This, in turn, will increase or decrease tax revenues depending on whether the marginal tax rate on labor earnings of H-types, τ_H, is larger or smaller than zero. Furthermore, as an increase in σ leads to an increase in higher education investments, public

[11] Suppose, on the contrary, that the self-selection constraint does not bind so that $\mu = 0$. Then, it follows from (3) and (5) that $u'_H = u'_L$ implying $v_H = v_L$. In light of the non-binding self-selection constraint this, in turn, implies $v_L \geq v_M$. Since $z_L \leq z(0)$, this requires that the mimicker does not invest in higher education (or excessively invests in higher education). However, since the mimicker's optimal choice is a strictly positive amount of educational investment, it follows that $v_M > v_L$ – a contradiction.

expenditures for higher education subsidies will increase. Generally, the fiscal effect is ambiguous. The incentive effect is given by the second summand on the right hand side of (8). It indicates, how an increase in higher education subsidization affects the self-selection constraint, i.e. the incentive of H-types to reveal themselves as highly talented. Since μ is strictly positive, the incentive effect is unambiguously negative.

The incentive effect can be isolated by considering an education subsidy starting from $\sigma = 0$, i.e. starting from a situation in which there is no public engagement in higher education. Recalling that $\tau_H = 0$ if $\sigma = 0$, it follows from (8) that:

$$\frac{d\Omega}{d\sigma}|_{\sigma=0} = -\mu \, e_M \, u'_M < 0.$$

Thus, introducing a higher education subsidy leads to a loss in social welfare. Conversely, a tax on higher education improves social welfare.

Proposition. Let the income tax system be set optimally. Then, starting from a situation without public engagement in higher education, a gain in social welfare is possible by imposing a tax on higher education.

The intuition underlying this result is as follows. At $\sigma = 0$ a marginal decrease in the subsidy, i.e. an introduction of a tax on higher education, amounting to $-d\sigma$, which is accompanied by a decrease in lump-sum taxes imposed on H-types amounting to $dt_H = -e_H \, d\sigma$, will leave the welfare of H-types as well as tax revenues unchanged. However, such a policy will harm a mimicking H-type, as the mimicker does not benefit from the decrease in the lump-sum tax rate but suffers from the tax on higher education. The welfare of a mimicking individual changes by $-e_M \, u'_M \, d\sigma$, relaxing the self-selection constraint. This leads to an increase in social welfare amounting to $\mu \, e_M \, u'_M \, d\sigma$ which is the decrease in welfare of the mimicking individual evaluated at the shadow price of the self-selection constraint μ.

Introducing a tax on higher education investments will affect the shape of the optimal income tax system. However, an analysis of the first-order conditions as such gives only little insight into the responses of the optimal income tax to a higher education tax. In particular, it says little about the possible change in income tax progression that comes along with a tax on higher education. In order to get an idea of how the shape of the optimal income tax system is affected if a tax on higher education is introduced, the next section applies equations (1) to

(7) to a simple numerical example.

4. A Numerical Example

Assume that the utility function takes the form $u(c-h) = \log(c-h)$, the function measuring the disutility of work in currency units takes the form $h(l) = .5\, l^2$, and the function relating investment in higher education to labor productivity takes the form $z(e) = 1 + e^{.2}$. Furthermore, let labor productivity of L-types to be equal to one so that $z_L = z(0) = 1$.

Table 1 presents some computations on the basis of this specification of the model. It contains the average tax rates on labor income of H-types, ϕ_H, and L-types, ϕ_L, where:

$$\phi_i = \frac{\tau_i\, l_i\, z_i + t_i}{l_i\, z_i}, \qquad i = H, L.$$

Furthermore, it contains a measure of the progression of the tax system denoted by ε. The progression measure ε consists of the (discretely defined) elasticity of the average tax rate with respect to a change in gross labor income, i.e.:

$$\varepsilon = \frac{\Delta\phi}{\Delta y}\,\frac{y}{\phi},$$

where $\Delta\phi = \phi_H - \phi_L$, $\Delta y = l_H\, z_H - l_L\, z_L$, $y = n_H\, l_H\, z_H + n_L\, l_L\, z_L$, and $\phi = n_H\, \phi_H + n_L\, \phi_L$. Thus, the progression measure ε takes the average of labor income and the average of average tax rates as the point of reference.

The first row below the heading of Table 1 presents these figures for the case that the government does not engage in higher education. These figures are computed by applying equations (1) to (6) to the numerical specification of the model as defined above with σ equal to zero. The second row presents the same figures on condition that the government combines an optimal income tax with an optimal higher education policy, i.e. with a tax on higher education. These figures are obtained by equating (7) to zero and combining it with equations (1) to (6).

In the present numerical example an optimal non-linear labor income tax system should be complemented by a tax on higher education investments amounting to roughly 2%. Introducing such a tax, average income tax rates of both H- and L-types decrease. However, the decrease in the H-types' average tax rate is rela-

	ϕ_H	ϕ_L	ε
$\sigma = 0$	.257	.218	.149
$\sigma = -.022$	.255	.217	.143

Table 1. Numerical Example

tively stronger than the decrease in the L-types' one. Thus, the main conclusion that can be drawn from this example is that the progression of the tax system, as measured by ε, decreases if a tax on higher education is introduced.[12]

5. Conclusion

The paper has shown that in the presence of an optimal labor income tax system designed to redistribute from high to low productive individuals a welfare gain is possible by taxing rather than subsidizing higher education. Moreover, by means of a simple numerical example it has been demonstrated that the income tax system should become less progressive if an optimal higher education policy is engineered. The results of this paper should not be interpreted so as to advocate a tax on higher education. In fact, the results have been based on an economy in which the market for higher education investments works perfectly and in which public policy is mainly concerned with redistributive objectives. The intention of the paper has rather been to demonstrate that in a world with well-functioning education markets, higher education subsidies are hardly consistent with standard equity arguments. Also the argument that in the presence of income tax progression higher education subsidies are justified on the basis that university graduates pay back the subsidies in the form of a higher tax burden loses its normative persuasiveness. The argument is merely fiscally oriented as it is not concerned with the negative incentive effects redistributive policies evoke. The results of the present paper suggest that rather than combining a progressive income tax sys-

[12] The numerical example has been chosen completely arbitrarily. However, the result that ε decreases if an optimal tax on higher education is introduced, is fully insensitive with respect to the choice of the parameters. Note that the particular choice of the income tax progression measure is not essential as it is not the degree of tax progression which is of interest but the direction of the change in tax progression.

tem with a subsidy on higher education as is common practice, higher education subsidies should, for equity reasons, be lowered and, at the same time, labor income taxes should be decreased. Lower education subsidies will decrease higher education investments. However, lower income taxes will increase them *and* will strengthen incentives to use the output of higher education productively.

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