Income Taxes, Death Taxes, and Optimal Consumption-Leisure-Savings-Choice

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by

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Abstract

An optimal taxation approach is employed to compare a proportional income tax with a death tax within a simple lifetime-cycle-model. The impact of both taxes is discussed concerning consumption, leisure, savings, and inheritance. It is shown that the income tax generally leaves the tax payer with a higher residual utility than does the death tax, if the same present value of tax receipts is supposed. Moreover, the death tax is much more limited concerning the maximum possible tax receipts than is the income tax. It is argued that there is a double dividend of heritages because of positive consumption externalities, which should not be destroyed by undue taxation. Taking that into account within a steady-state OLG- model, the death tax turns out to be the least efficient tax at all.

Introduction

The traditional theory of optimal taxation has concentrated on the dead weight loss caused by consumption taxes (Ramsey 1927; Atkinson/Stiglitz 1972; Auerbach 1985; Homburg 2006). Its central issue is the minimization of distortions from a first best allocation to be caused by taxation, but not redistribution. The theoretically best solution of the pure allocation problem were either lump sum taxes or a general commodity tax on all consumption goods including leisure, which is of course a perfect equivalent (Homburg 2007, 151).

Because leisure cannot be taxed directly, second best solutions have been developed for the taxation of consumption goods. In particular, according to Ramsey`s rule (Ramsey 1927), commodities should be taxed inversely to their elasticity of demand. The argument is, that with only weak consumer reactions on the tax, distortions from the optimal allocation are also small. Although this principle is valid only under special conditions even in the commodity taxation case[1], it is sometimes also extended to redistributive taxes. Applying Ramsey`s rule to optimal income taxation, for example, would apparently mean to burden those most who have the least options to evade.

It is highly questionable, however, that such a solution would be chosen behind Harsanyis` veil of ignorance, which is the base of modern theory on optimal redistribution. According to that theory, the unborn individuals would rather seek to maximize their expected utility value (Mirrlees 1976; Diamond/Mirrlees1971). Hence, with a given amount of required tax receipts, they should chose a taxing scheme that maximizes the expected remaining utility from private net income.

In the sequel it is examined whether a proportional income tax or a death tax is preferable with that objective. Although there is an intensive debate on the warranty of inheritance taxes in the political world, remarkably little theoretical work has been done on the issue. Most of the theoretical literature on optimal taxation either neglects inheritance taxes or deals with the issue only along the way (e.g. Bernheim 1999, 33). Seidman (1983, 439) shows that a bequest motive undermines the neutrality of a consumption tax, if the bequest is left tax free, but could lead to a higher steady state capital intensity than a working tax. No comparison is made, however, concerning the remaining utility level. Sexauer (2004, 77-), following an approach by Gale/Perozek (2001), discusses the death tax within an OLG model, but does not make an explicit comparison to an equivalent income tax,[2] nor does he arrive at a clear-cut result concerning efficiency.

The Model

We adopt a very simple model with two groups of people, the rich and the poor. The rich shall be taxed in order to support the poor, either by direct transfers or by any specific public good. We do not explicitly model the poor group but simply assume that a certain amount of tax

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[1] In particular, cross-price elasticities must be zero, see Homburg (2007), 158-59
[2] He makes a remark that such a comparison would be interesting, but renders his model as inappropriate for this purpose (Sexauer 2004, 151).

receipts is required to prepare for their needs. Hence the problem condenses to the question how to collect the required resources from the rich.

The latter command a life-time budget b which they can devote to either work w or leisure v. Hence, if the wage level is normalized to unity, w = b – u is their total lifetime income, which can be used for either consumption c or savings s. Savings yield an interest rate i and occur only in order to provide for the next generation. Hence, in the absence of any taxation, the individual`s set of budget constraints is

$$(1) c = b - v - s$$
$$(2) h = s(1 + i)$$

where h denotes the heritage which is left to the next generation. We assume the individual utility function

$$(3) U = c^\alpha h^\beta v^\gamma$$

which can be written in logarithmic terms as $\ln u = \alpha \ln c + \beta \ln h + \gamma \ln v$. The quotients β / α and γ / α can be viewed as weigths which are given by the individual to the benefits of the next generation and to leisure with respect to her own consumption c.

Maximizing (3) with respect to (1) and (2) yields

$$(4) c^* = \frac{\alpha b}{\alpha + \beta + \gamma}$$
$$(5) h^* = \frac{(1 + i)\beta b}{\alpha + \beta + \gamma}$$
$$(6) v^* = \frac{\gamma b}{\alpha + \beta + \gamma}$$

Not surprisingly, leisure rises in γ and heritage rises in both β and i. Note that, with $\beta = 0$, the individual does not care about future generations at all and, hence, will try to reduce heritage h to zero. It is sometimes argued that, due to the uncertainty of lifetime, even in this case there would accrue a considerable amount of heritage nevertheless. However, at least with a perfect capital market, that is not necessarily true. For then the individual could sell her properties, when the end of his normal lifespan approaches, in exchange for a fair rent, which is paid to her till the definite end of her life. By means of such a reverse mortgage-approach she could, on the one hand, perfectly prepare for her old age and, on the other hand, prevent any payment of death tax.

The other extreme, with $\beta = \alpha$, would imply that the individual cares for the next generation`s benefit to the same extent as she cares for her own. Normally, one would expect that $0 < \beta < \alpha$, although in principle even $\beta > \alpha$ could occur.

Income Taxation

If a proportional income tax t is imposed on both labour and interest income, the budget constraints change to

$$(1i)c = (b-v)(1-t) - s$$
$$(2i)h = s(1+i) - sit$$

For simplicity, we make use of the following auxiliary variables:

$$x \equiv i(1-t)^2 - (t-1) > 0$$
$$z \equiv 1 + i(1-t) > 1$$

Then the new optimal consumption-heritage-leisure-pattern can be written as

$$(4i)c_t^* = \frac{x}{z}\frac{\alpha b}{\alpha + \beta + \gamma}$$

$$(5i)h_t^* = x\frac{\beta b}{\alpha + \beta + \gamma}$$

$$(6i)v_t^* = \frac{\gamma b}{\alpha + \beta + \gamma}$$

Note that, other than the leisure/consumption ratio v/c, absolute leisure time v is not raised by the income tax. The negative income effect of the tax here just outweighs the substitution effect. In contrast, savings are absolutely reduced by the income tax, but not in relation to consumption.[3] The private saving rate remains the same, because both current and future income is reduced by the income tax. Nether the less, the heritage slightly decreases with an increasing tax rate, because of the reduced net interest on savings.

One could argue that there is a negative welfare effect from income taxation due to the reduced total amount of private savings.[4] That would imply, however, that there is an external effect from private saving that does not enter her utility function. Otherwise the tax surely should be collected by causing the least achievable sacrifice to those who have to bear the tax burden, independent from the composition of individual utility concerning saving and consumption.

With the non-separable utility function (3) income taxation neither reduces work nor total income. The crucial question remains, however, if there is a better taxation scheme to yield the same amount of revenues with less sacrifice to the taxpayer.

Death Taxation

A frequently supposed candidate is the death tax. Because it accrues not before human life has ended, it is supposed to create much less tax evasion and, hence, less distortion of incentives

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[3] From s = (b-u)(1-t)-c_t and (4i) it follows that $s^*/c_t^* = (b-v)(\alpha + \beta + \gamma)/(\alpha b) - 1$

[4] The effect on total savings would have to include both the saving reactions of the children and the state; then there is no generally valid result, see Sexauer (2004), 91

to work and saving. In particular, if the individual does not care about what happens to her estate after death, a death tax is supposed to be both harmless to her welfare and perfectly neutral with respect to her allocation of resources.

With a death tax instead of the income taxation the set of restrictions in our model changes to

$$(1ii)c = b - v - s$$
$$(2ii)h = s(1+i)(1-d)$$

where d is the rate of the death tax. In addition to the auxiliary variables x and z, which were defined above, in what follows we make also use of

$$y \equiv (1-d)(1+i) > 0$$
$$k \equiv t(1+2i-it) > 0$$

The new optimal allocation scheme is then

$$(4ii)c_d^* = \frac{\alpha b}{\alpha + \beta + \gamma}$$

$$(5ii)h_d^* = y\frac{\beta b}{\alpha + \beta + \gamma}$$

$$(6ii)v_d^* = \frac{\gamma b}{\alpha + \beta + \gamma}$$

Hence, both present consumption c and leisure v remain totally unaffected by the death tax, which is in perfect harmony with the common view. The tax reduces only the heritage h and, hence, indeed seems to reveal the pleasant properties which it is usually supposed to have.

Income Tax and Death Tax in Comparison

The picture changes radically, however, if the level of utility is regarded which is left to the individual with the death tax in comparison to an income tax. This does, of course, make sense only with a given amount of tax receipts, or - to be more precise - with a given *present value* of tax receipts. The latter takes into account that , on average, the death tax receipts accrue later to the state than do the income tax receipts. Hence, a change of the taxing scheme from the latter to the former would imply some interest costs.

From equations (1i), (2i) and (2ii) the present values of tax receipts are calculated as

$$(7)PV_t = t(b-v) + \frac{it[(b-v)(1-t) - c_t]}{1+i}$$

and

$$(8)PV_d = d(b-v) - dc_d$$

Remember that v and b-v are the same with the two taxing schemes. Equating (7) and (8) yields the death-tax rate d^* which is equivalent to a given income-tax rate t:

$$(9)d^* = \frac{(b-v)k - itc_t}{(b-v-c_d)(1+i)} \quad \text{with } 0 < d^* \leq 1$$

Inserting the optimal c_t and c_d into (9) and making use of (5i), (5ii), (6i) and (6ii) yields

$$(9i)d^* = \frac{(\alpha+\beta)k - it\alpha x/z}{\beta(1+i)} \quad \text{with } 0 < d^* \leq 1$$

Note that, with a given income tax rate t, a minimum value of β is required to make sure that there is a valid solution of d^* at all. For example, in contrast to an income tax, with $\beta \to 0$ there would not be any receipts from a death tax, even with $d = 1$. Accordingly, as d^* is not allowed to exceed unity, $y = (1-d)(1+i) \geq 0$ must hold. From that the minimum required β is calculated by inserting (9i) into y as

$$(10)\beta_{min} = \frac{kz - itx}{(1+i)z - kz} \quad \text{with} \quad i \geq 0 \quad ; \ 0 < t < 1$$

which we will later make use of.

The crucial question is whether U_t or U_d remains higher with a given tax receipt PV. By inserting the respective optimal values of c, v and h into (3), the problem can be written as

$$(11)\frac{U_t}{U_d} = \frac{c_t^\alpha v_t^\beta h_t^\gamma}{c_d^\alpha v_d^\beta h_d^\gamma} = \frac{c_t^{\alpha+\beta+\gamma} z^{\beta+\gamma}}{c_d^{\alpha+\beta+\gamma} y^\beta x^\gamma} \overset{?}{>} 1 \quad \text{for} \quad i \geq 0; \quad 0 < t < 1$$

From (4i) and (4ii) it follows that

$$(4iii)\frac{c_t}{c_d} = \frac{x}{z}$$

By employing (4iii), equation (11) is reduced to

$$(11i)\frac{U_t}{U_d} = \left(\frac{x}{z}\right)^{\alpha+\beta} \left(\frac{z}{y}\right)^\beta \overset{?}{>} 1 \quad \text{for} \quad i \geq 0 \ ; \ 0 < t < 1$$

Note that γ, i.e. the weight of leisure, does not matter here at all, which corresponds to our result that v is the same with both taxing schemes anyway.

Does the inequality (11i) actually hold? Because of the linear homogeneity of (3), α can be normalized to unity without any loss of generality. At first we prove that (11i) holds in the special case where $\beta = \alpha = 1$, i.e. with a fairly altruistic individual, who weights the next generation`s welfare as high as her own consumption. (11i) can then be further reduced to

$$(11ii)\frac{U_t}{U_d} = \frac{x^2}{zy} \overset{?}{>} 1 \quad \text{for } \alpha = \beta = 1 \ ; \ i \geq 0 \ ; \ 0 < t < 1$$

By inserting the respective expressions for x, y and z defined above, from (11ii) we get

$$(11iii) i(2 + t^2 - 3t) + 2 \overset{?}{>} 0$$

By differentiation of the term in brackets with respect to t, its minimum value is calculated as -0.25 for $t^* = 1.5$, which is of course an invalid solution. Hence, the minimum allowed value of (11iii) is found for $t \to 1$ with $2 > 0$, and, hence, $U_t > U_d$ for $\beta = \alpha = 1$, q.e.d.

Next we proof that this result holds also true in the more general case $\beta_{min} < \beta < \alpha = 1$. We first show that

$$(12) \frac{\delta\left(\frac{U_t}{U_d}\right)}{\delta\beta} < 0 \qquad \text{for } \beta = \beta_{min}$$

By employing both the chain rule and the product rule, the solution of (12) yields the general result[5]

$$(12i) \frac{\delta\left(\frac{U_t}{U_d}\right)}{\delta\beta} = \left(\frac{\bar{x}}{\bar{z}}\right)^\alpha \left(\frac{\bar{x}}{y^*}\right)^\beta \left[\ln(\bar{x}) - \ln(y^*) - \beta \frac{\delta y^* / \delta\beta}{y^*}\right] \overset{?}{<} 0$$

with

$$(13) y^* = (1+i)(1-d^*) = (1+i) - k\beta^{-1} - k + \frac{itx}{z}\beta^{-1}$$

$$(14) \frac{\delta y^*}{\delta\beta} = \alpha k\beta^{-2} - \frac{it\alpha x}{z}\beta^{-2}$$

Because the first two terms in (12i) are clearly positive, we would have to show that the term in the squared brackets is negative. By making use of (13) and (14) this can be written as

$$(12ii) y^* \ln(\bar{x}) - y^* \ln(y^*) + y^* + k - (1+i) \overset{?}{<} 0 \qquad \text{for } i \geq 0 \quad ; \quad 0 < t < 1$$

For $\beta \to \beta_{min}$, we know from (10) that $y^* \to 0$. Therefore, the first three summands of (12ii) all approach zero if β approaches β_{min}. Hence we are left with

$$(12iii) k - (1+i) = (t + 2it - it^2) - (1+i) \overset{?}{<} 0 \qquad \text{for } \beta \to \beta_{min} \; ; \; i \geq 0 \; ; \; 0 < t < 1$$

Differentiation of the first bracket term in (12iii) shows that it reaches its maximum value at the invalid solution $t^* = 1 + 1/(2i) > 1$. Its maximum *valid* value is reached for $t \to 1$ (with its minimum valid value being realized at $t = 0$). Therefore,

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[5] I thank Jürgen Mutzberg for his help with this differentiation.

$(12iv)(t + 2it - it^2) - (1+i) < 0$ for $0 < t < 1$

The last step of our proof is to show that the value of (12i) rises for any $\beta > \beta_{min}$. This can be accomplished by examining if the first three summands in (12ii) rise in β and, hence,

$$(12)\frac{\delta^2\left(\dfrac{U_t}{U_d}\right)}{\delta\beta^2}\overset{?}{>}0 \quad \text{for } \beta \geq \beta_{min}$$

Figure (i) illustrates the line of the proof. With point N exceeding unity, as it was proved by (11iii), it follows from (12) that the U_t/U_d-curve has a negative slope in M. If the slope of the curve rises (i.e. the negative steepness diminishes) with rising β, as it is indicated in the figure, this would proof that U_t/U_d is above unity for any $\beta \geq \beta_{min}$.
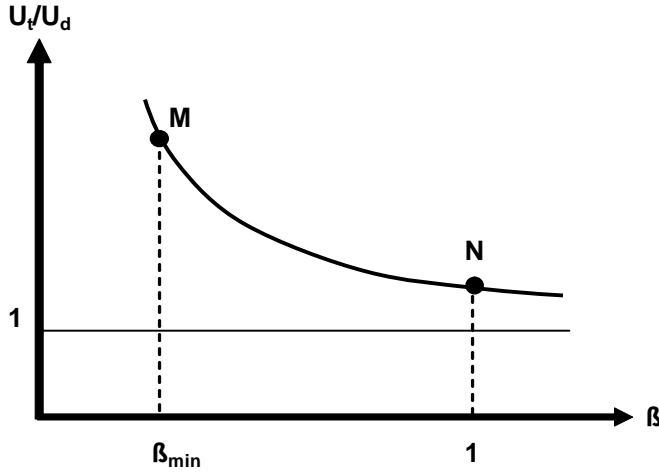

Figure (i): Utility Relation U_t / U_d as a function of Parameter β

To complete the proof we define

$$(13)g(\beta) \equiv y^* \ln \overline{x} - y^* \ln y^* + y^*$$

and differentiate with respect to β by applying the chain rule and the product rule:

$$(15)\frac{\delta g(\beta)}{\delta\beta} = \frac{\delta y^*}{\delta\beta}\left(\ln \overline{x} - \ln y^*\right)\overset{?}{>}0$$

From (14) it can be derived that $\delta y^* / \delta\beta > 0$.[6] The term in brackets is positive if $x > y^*$, i.e. we have to examine

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[6] With $\alpha = 1$, the positiveness of (14) implies $t\left[1 + i(2-t) + i^2(1-t)\right] > 0$, which is clearly true for $t \leq 1$.

$$(16)(it^2 - 2it + i) - (t - 1) \overset{?}{>} (1 + i) - k + (itxz^{-1} - k)\beta^{-1}$$

It can be shown that $itxz^{-1} - k < 0$,[7] and hence relation (16) is generally valid, if it is valid for β_{min}. By substituting (10) for β_{min} in (16) and after rearranging terms, we finally arrive at

$$(16i)[(1 + i) - k]z = [1 + i(1 - t)^2 - t]z \overset{?}{>} 0$$

which is clearly true for $t \leq 1$, q.e.d.

Figure (ii) illustrates a numerical example with an assumed interest rate $i = 0.1$, a time budget $b = 5$ and $\alpha = \gamma = 1$.[8] The three curves relate to different income tax rates $t = 0.1$, $t = 0.2$ and $t = 0.3$ respectively (bottom up). The corresponding β_{min} are 0.11, 0.25 and 0.44. With an income tax-rate $t = 0.5$, which is thoroughly customary with higher incomes in most countries, β_{min} would already exceed unity and, hence, require an extreme degree of altruism to make a death tax yield any receipts at all.
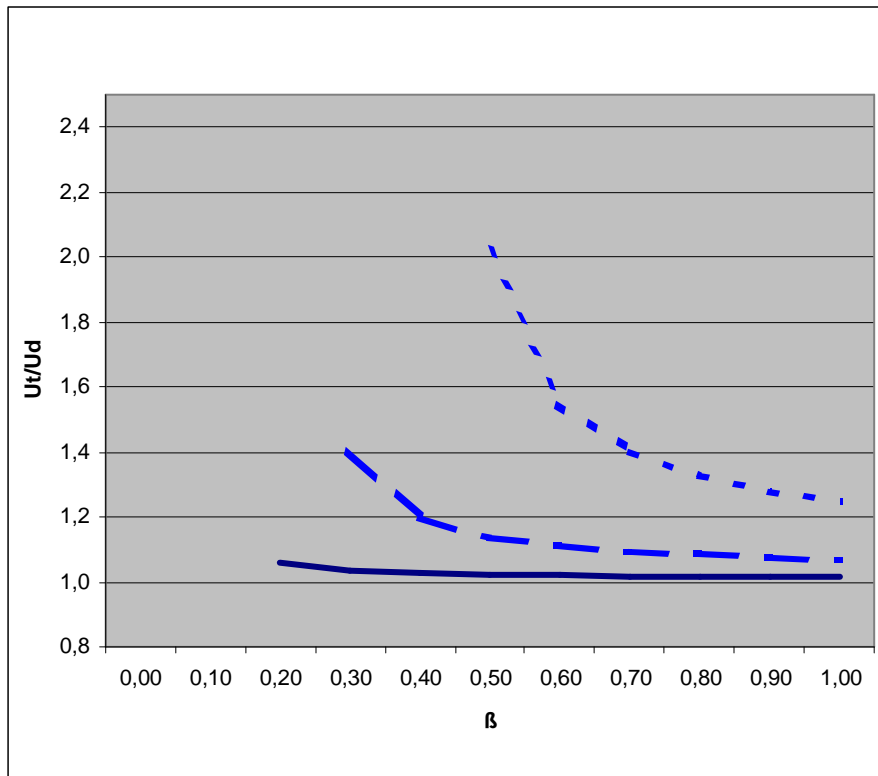

Figure (ii): U_t / U_d **as a Function of** β **with Different Income Tax Rates t**

Even with a β as high as desired, U_t / U_d never undergoes unity, howsoever the other parameters are chosen. Moreover, if β exceeds β_{min}, the required death tax rates are generally more than twice the respective income tax rates. Of course, these relations depend in detail on the particular assumptions to be made. They might nevertheless contribute to

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[7] The proof leads to the same relation as in the footnote above.

[8] Only the interest rate i and the relation β / α matters for the relation U_t / U_d.

explain the fairly low share of death taxes in total tax receipts which are observed in all but every modern state.

Steady State Comparison

Our model is still incomplete, as it concentrates on the utility of the testator, without explicitly taking into account the perspective of the heir. In a steady state overlapping generations model, it must be taken into account that the bequest of the elder is an additional resource for the younger. Hence there accrues a kind of double-dividend from the heritage, which raises the utility of both the testator and the heir. Depending on the value of β, this positive consumption externality could reach a substantial amount. This effect even enlarges the relative advantage of an income tax compared with a death tax, because the latter reduces or even destroys the positive externality, while the former does not.

From the viewpoint of the heir, the bequest $\bar{h}$ is a constant, which is, in principle, equivalent to a larger time budget b. Yet, with an income tax t, her optimal life-cycle plan changes in comparison to equations (4i) to ((6i), because the heritage is normally not covered by the income tax. Equally, the optimal death tax solution changes in comparison to equations (4ii) to (6ii), because the optimal heritage h^* and, hence, now also the optimal consumption c^* is dependent from the death-tax rate d.

We discuss the steady-state model within a somewhat broader concept which allows for four different taxes and also for any combination of them. In particular, we examine a consumption tax t_c, a pure labour income tax t_b, a combined and identical tax on both labour and interest income $t = t_b = t_i$ (i.e. our formerly income tax), and a pure death tax d. We also allow for a death tax which is incorporated in the normal income tax such that $t = t_b = t_i = d$, as it is sometimes supposed. Hence we have the new budget constraints

$$(1iii)\, c(1 + t_c) = \bar{h} + (b - v)(1 - t_b) - s$$
$$(2iii)\, h = \left[s(1 + i) - sit_i \right](1 - d)$$

By introducing the new auxiliary variable

$$\omega \equiv t_h + t_h i - it_i t_h + it_i - i$$

and regarding that, in a stationary steady state equilibrium, $h^* = \bar{h}$ must hold,[9] we arrive at the following general solution for the optimal life-cycle plan:

$$(4iii)\, c^* = \frac{\alpha b(1 - t_b)}{(1 + t_c)(\alpha + \beta\omega + \gamma)}$$
$$(5iii)\, h^* = \frac{(1 - \omega)\beta b}{\alpha + \beta\omega + \gamma}$$
$$(6iii)\, v^* = \frac{\gamma b}{\alpha + \beta\omega + \gamma}$$

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[9] In an economy growing at rate g the relation were of course $h^* = \bar{h}(1 + g)$.

The now more general formula for the present value of total tax receipts is

$$(7i)\, PVT = t_c c + t_b (b - v) + \frac{t_i si}{1+i} + \frac{dh}{1+i}$$

where the tax receipts from the interest tax and from the death tax are discounted, because they accrue only in the second period.[10] The crucial question is again which tax - or which combination of taxes - leaves the taxpayer with the largest residual utility, if the present value of total tax receipts is given.

A respective analytic comparison of all possible tax-combinations in analogy to the paragraphs above would be extremely cumbersome. Therefore, we confine ourselves to both heuristic arguments and a numerical example (see the table).

Assumptions						
α	1,00	1,00	1,00	1,00	1,00	1,00
β	0,50	0,50	0,50	0,50	0,50	0,50
γ	1,00	1,00	1,00	1,00	1,00	1,00
b	5,00	5,00	5,00	5,00	5,00	5,00
i	0,10	0,10	0,10	0,10	0,10	0,10
Taxed Subject						
	without	consumption	labour-income	total income	total income incl. heritage	heritage
tax-rates						
t_c		0,08				
t_b			0,08	0,08	0,05	
t_i				0,08	0,05	
d					0,05	0,28
Results						
s	1,43	1,43	1,31	1,30	1,24	0,99
c	2,57	2,37	2,36	2,36	2,39	2,40
h	1,57	1,57	1,44	1,42	1,29	0,79
v	2,57	2,57	2,57	2,57	2,52	2,40
U	**8,29**	**7,64**	**7,29**	**7,23**	**6,84**	**5,09**
PVT	0,00	0,20	0,20	0,20	0,20	0,20
Relations						
s/c	0,56	0,60	0,56	0,55	0,52	0,41
h/c	0,61	0,66	0,61	0,60	0,54	0,33
v/c	1,00	1,08	1,09	1,08	1,06	1,00

Table: Remaining Utility with Different Taxing Schemes

In the columns six different tax-scenarios are listed, beginning with the no-tax-case and then sorted in descending order of remaining utility U for the required PVT (= 0.2 in the example). In accordance with the general results of optimum tax-theory, the consumption tax ranks first. It is followed by a pure labour-income tax, which in turn proves better that an income tax

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[10] This is not at all irrelevant in a steady state, because any change in the tax structure towards t_i or d would still cause some interest costs.

including interest income.[11] An income tax which would also cover heritages with the normal rate were even worse, and the worst of all turns out to be a pure death tax.[12]

The table is only one example of numerous simulations which have been done, all of them yielding the same general result. Hence, the steady state approach strengthens the argument against the death tax, and it does so primarily because of the double-dividend-effect. Indeed, according to the simulations, the higher is β and, hence, the more relevant is the positive consumption externality which the heritance-motive implies, the larger becomes the relative advantage of the income tax (and of all the other taxing schemes) above the death tax. The double-dividend argument also clearly shows that a nearly 100 percent death tax, as it was proposed by such prominent liberals as Adam Smith and John Stuart Mill, would be extremely inefficient. Not only would the receipts of such a tax be very small, but it would nearly totally destroy the costless benefit of the consumption externality.

We do not go into more detail here with the steady state approach, which could be extended in many ways. In particular, it would be interesting to compare the taxing schemes with a growing economy and/or a declining population. Of course, a more general proof of its results would also be welcome. A corresponding approach is, however, left to subsequent research.

Concluding Remarks

Efficiency is not the only thing which matters. One might thoroughly argue in favour of a death tax on egalitarian grounds. It should be kept in mind, however, that not only the heir`s, but also the devisor`s utility is thereby reduced. The only exception were a devisor who is totally unconcerned to the time after his death (i.e. $\beta = 0$), but then she would not voluntarily leave a heritage at all. Hence a death tax, at least if it is meant to yield a substantial receipt, necessarily impairs the decedent. Moreover, as has been shown above, the loss in the tax-payer`s utility is c.p. higher with a death tax than it was with any other tax or combination of them. An egalitarian might shrug her shoulders on this point. However, she should beware of other countries which entice the rich from their greedy grips by means of a smarter taxing scheme. According to our results, these countries could even do so without any loss in total tax receipts.

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[11] A pure tax on interest income could not yield the required PVT in the example at all.

[12] In accordance with our previous results and similar to a pure interest taxation, the receipts of a pure death tax are again dependent on β and very limited in their highest-possible volume.

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