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DOES OLD CAPITAL MATTER FOR IMPLEMENTING A PARETO-IMPROVING TAX REFORM?

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Is it possible to replace the income tax by a consumption tax or a wage tax such that (1) a dynamic (intergenerational) Pareto improvement is obtained and (2) only the information available from enforcing the income tax is used? In this article, it is shown that such a transition is feasible if and only if in a static setting, the consumption or wage tax induces less distortions than the income tax.

Keywords: consumption tax; income tax; intergenerational redistribution; transition

1. INTRODUCTION

The proposal to replace income taxes by consumption taxes is a recurrent theme in the political debate.¹ Such a reform has two effects. First, both taxes induce different *static* distortions. The consumption tax does not affect the consumption-savings margin, but with a given revenue requirement, it must distort the labor supply decision more severely than the income tax does. Second, in a *dynamic* environment, a switch to the consumption tax induces an implicit lump-sum levy on existing wealth. The resulting efficiency gain, however, implies an intergenerational redistribution at the expense of older individuals.

This article aims at disentangling these effects by undoing the intergenerational redistribution induced by the reform. For that purpose, we assume that the government may pay transfers to the old generation of the transition period, which has to rely on the same information as the current income tax. The compensating payments must be covered by consumption tax revenues, but public debt is allowed to adjust. Based on simple reasoning, it is shown that under these conditions, the transition from the income tax to the consumption tax is Pareto improving in the dynamic environment if and only if the consumption tax is less distortionary than the income tax in a static setting. Thus, the implicit capital levy is irrelevant for the welfare evaluation of the tax reform.

The wage tax induces the same static distortions as the consumption tax. Moreover, with variable government debt, the timing of tax payments is irrelevant (see Seidman 1990). Therefore, the result holds for a transition to the wage tax as well. Provided the consumption (or wage) tax is preferable in a static setting, it is further shown that in a dynamic setting, the income tax can be replaced in a Pareto-improving way by any of the following: (1) a consumption tax combined with a proportionate subsidy on asset holdings, (2) a wage tax combined with a proportionate tax on asset holdings, and (3), as suggested by Gravelle (1994, 42), a combination of a wage and a consumption tax without any compensating tax or transfer.

Dynamic tax reforms have been the object of numerous studies.² Previous work separating efficiency from redistribution has found that the dynamic effect has some influence on welfare despite the compensation. This article differs from these results by the instruments that are considered to compensate the transition generation. Auerbach, Kotlikoff, and Skinner (1983) and Auerbach and Kotlikoff (1987) introduce an additional government agency that can collect lump-sum taxes from and pay lump-sum transfers to each individual. These lump-sum payments depend on the parameters of preferences and technologies and thus make use of more information than the transfers analyzed in this study. In addition, the compensating transfers in our setup are paid out of consumption tax revenues, whereas the lump-sum transfers and taxes used in Auerbach, Kotlikoff, and Skinner (1983) and Auerbach and Kotlikoff (1987) must add to zero in present values. Compensating the old then implies a lump-sum tax

on the young. This lump-sum tax allows for a welfare gain in the transition that is not available in a pure consumption tax regime, as is analyzed in this study.

In the compensation schemes presented by Gravelle (1991) and Keuschnigg (1996), transfers have to sum to zero in every period. Contrary to our approach, this precludes a change in government debt during the transition. Lewis and Seidman (2000) suggest exempting a given fraction of the assets held by any individual from consumption tax. This, however, fails to completely compensate retirees, and hence the reform is not Pareto improving. Similar to our result, Atkinson and Sandmo (1980) show that static considerations determine the efficiency comparison between income tax and consumption tax in a dynamic model as long as debt policy is available. Our approach is complementary to that work that focuses on steady states, whereas we are concerned with the transition.

The issue addressed in this study is similar to the question of whether a Pareto-improving transition from a pay-as-you-go to a fully funded pension system is possible. Like a switch to the consumption tax, a move to a fully funded pension system may benefit all future young generations but hurts the old generation in the transition period. As shown by Breyer (1989) and Fenge (1995), a Pareto-improving transition is impossible unless the pay-as-you-go pension system imposes some additional static inefficiency.³ This result is analogous to our finding on tax reform because we also show that—if a Pareto improvement is required—the redistributive effects concerning the old generation in the transition period become irrelevant such that welfare effects of the reform depend only on the static distortions imposed.

The rest of the article is organized as follows. In the next section, the model is presented. In section 3 the transition from income to consumption (wage) taxation is analyzed. Section 4 concludes.

2. THE MODEL

We consider a stationary overlapping generations economy with $H \geq 1$ household types. In each generation, there is one household of each type, indexed by $h = 1, 2, \dots, H$. Individuals of the same type

h are identical except for their birth date. The life span is two periods. A young individual decides on consumption demand c_1^h , labor supply l^h , and saving s^h in youth and consumption demand c_2^h in old age. Preferences of a type h household are described by the utility function $u^h(c_1^h, c_2^h, l^h)$, which is increasing in both consumption variables and decreasing in labor supply. In the beginning of the second period of a household's lifetime, all decisions are taken. Therefore, once old, a household of type h is only interested in the second-period consumption, c_2^h . This is a small, open economy integrated in a steady-state world economy with perfect labor and capital markets. Thus, the wage rate w and the interest rate r are exogenous and constant over time.

The government has a per period revenue requirement $b > 0$ representing both public goods supply and interest payments on some historically given debt. It may tax wage and interest income at rates $\tau_w \in [0, 1]$ and $\tau_r \in [0, 1]$, respectively. This yields the following budget constraints of a household h in youth and old age:

$$\begin{aligned} c_1^h + s^h &= (1 - \tau_w)wl^h, \\ c_2^h &= [1 + r(1 - \tau_r)]s^h. \end{aligned}$$

Eliminating savings s^h from both equations, one obtains the intertemporal budget constraint (1), which determines the decision problem faced by a young household in the beginning of the life cycle:

$$\begin{aligned} \max_{c_1^h, c_2^h, l^h} \quad & u^h(c_1^h, c_2^h, l^h) \\ \text{s.t.} \quad & c_1^h + \frac{c_2^h}{1 + r(1 - \tau_r)} = (1 - \tau_w)wl^h. \end{aligned} \quad (1)$$

Because wages and interest rates are constant, this choice only depends on the tax rates. Hence, consumption demands and labor supply can be written as $c_1^h(\tau_w, \tau_r)$, $c_2^h(\tau_w, \tau_r)$, and $l^h(\tau_w, \tau_r)$. The indirect utility is given by $v^h(\tau_w, \tau_r) = u^h(c_1^h(\tau_w, \tau_r), c_2^h(\tau_w, \tau_r), l^h(\tau_w, \tau_r))$.

Household h pays taxes $\tau_w wl^h$ in youth and $\tau_r r[(1 - \tau_w)wl^h - c_1^h]$ in old age. Taking into account optimal decisions, the present value of tax receipts collected from this household is

$$\begin{aligned} T^h(\tau_w, \tau_r) &:= \tau_w wl^h(\tau_w, \tau_r) \\ &+ \frac{\tau_r r}{1 + r} [(1 - \tau_w)wl^h(\tau_w, \tau_r) - c_1^h(\tau_w, \tau_r)]. \end{aligned} \quad (2)$$

At the beginning of their lifetime, the aggregate present value of tax payments by a generation is $T(\tau_w, \tau_r) := \sum_{h=1}^H T^h(\tau_w, \tau_r)$.

In a steady state with a comprehensive income tax ($\tau_w = \tau_r = \tau_l$), in every period, household type h saves $s_l^h(\tau_l) := (1 - \tau_l)wl^h(\tau_l, \tau_l) - c_1^h(\tau_l, \tau_l)$, and the government satisfies the budget constraint

$$\tau_l w \sum_{h=1}^H l^h(\tau_l, \tau_l) + \tau_l r \sum_{h=1}^H s_l^h(\tau_l) = b. \quad (3)$$

Alternatively, the government may impose a consumption tax. It is convenient to express the consumption tax by means of a rate $\tau_c \in [0, 1]$ applied to the tax-inclusive base.⁴ This implies the budget constraints

$$c_1^h = (1 - \tau_c)(wl^h - s^h), \quad (4)$$

$$c_2^h = (1 - \tau_c)(1 + r)s^h. \quad (5)$$

Eliminating savings s^h yields the intertemporal budget constraint

$$c_1^h + \frac{c_2^h}{1 + r} = (1 - \tau_c)wl^h. \quad (6)$$

This is the same as (1) with $\tau_w = \tau_c$ and $\tau_r = 0$. Therefore, with a consumption tax, the young household's demand and supply functions are $c_1^h(\tau_c, 0)$, $c_2^h(\tau_c, 0)$, and $l^h(\tau_c, 0)$. The indirect utility is $v^h(\tau_c, 0)$.

To compute consumption tax payments, observe that tax liabilities in youth are the difference between wage income and expenditures for consumption and saving, $wl^h - c_1^h - s^h$. From the first-period budget constraint (4), this is equivalent to $[\tau_c/(1 - \tau_c)]c_1^h$. In old age, taxes are computed as the difference between the household's gross return on saving and consumption, $(1 + r)s^h - c_2^h$. Eliminating s^h and c_2^h with the help of (4) and (5), this is equivalent to $\tau_c(1 + r)[wl^h - c_1^h/(1 - \tau_c)]$. Discounting this payment with $(1 + r)$ and adding the tax payment in youth $[\tau_c/(1 - \tau_c)]c_1^h$ yields the present value of the household's consumption tax liabilities, $\tau_c wl^h(\tau_c, 0) = T^h(\tau_c, 0)$. Hence, the present value of a young household's consumption tax payment is the same as the present value of his or her tax payment if a wage tax is levied at the same rate and interest income is not

taxed. More generally, in a young household's consumption demand, labor supply, indirect utility functions, and tax payment, consumption tax and wage tax are interchangeable. Thus, we may write $v^h(\tau_y, 0)$ and $T^h(\tau_y, 0)$ for any combination of wage and consumption tax at a combined rate $\tau_y = \tau_w + \tau_c(1 - \tau_w)$.

3. THE TRANSITION

In the following, we analyze under what conditions a transition from income to consumption or wage taxation exists that is beneficial for all generations, including those already retired in the transition period (dynamic Pareto improvement). It will be shown that the relevant criterion follows from the comparison between the distortions imposed by the tax system on a single generation (static Pareto improvement). This means that the indirect effect of the tax reform on the initial wealth of the elderly becomes irrelevant. To make precise the distinction between Pareto dominance in the static and dynamic sense, we give the following definition, which compares the wage/consumption tax with a comprehensive income tax from the point of view of a young generation.

Definition 1. The wage/consumption tax at a combined rate $\tau_y = \tau_w + \tau_c(1 - \tau_w)$ *statically* Pareto dominates the income tax at rate τ_I if

- (i) $T(\tau_y, 0) \geq T(\tau_I, \tau_I)$, and
- (ii) $v^h(\tau_y, 0) \geq v^h(\tau_I, \tau_I)$ for all $h = 1, 2, \dots, H$,

where at least one inequality is strict.

The inequality (i) in Definition 1 says that under the wage/consumption tax, the lifetime tax payment of a generation is at least as large as under the income tax. The inequalities (ii) in Definition 1 require that all types of households are at least as well off under the wage/consumption tax as under the income tax.⁵ Finally, the definition requires that the government's tax revenue or the utility of at least one household is strictly larger under the wage/consumption tax than under the income tax.

In the dynamic model, the economy initially is in a steady state with a comprehensive income tax. The tax reform takes place in

Period 0. This change was not anticipated, but now everyone believes that the new tax regime with rates τ_c and τ_w will remain in force forever. The old generation of the transition period must now pay the consumption tax on the assets $(1+r)s_I^h(\tau_I)$, which they have accumulated previously. In addition, the government pays each member $h = 1, \dots, H$ of this generation a transfer z^h , which may be negative and is itself subject to the consumption tax. Thus, after the reform, the consumption of old individual h in Period 0 is given by $c_{2,0}^h(\tau_c, z^h, \tau_I) := (1 - \tau_c)[(1+r)s_I^h(\tau_I) + z^h]$.

Definition 2. The transition from the income tax at rate τ_I to the wage/consumption tax at rates τ_w and τ_c with the transfers $z^h, h = 1, \dots, H$ is a *dynamic* Pareto improvement if

- (i) $\frac{1+r}{r}T(\tau_w + \tau_c(1 - \tau_w), 0) + \tau_c \sum_{h=1}^H [(1+r)s_I^h(\tau_I) + z^h] - \sum_{h=1}^H z^h \geq \frac{1+r}{r}b,$
- (ii) $v^h(\tau_w + \tau_c(1 - \tau_w), 0) \geq v^h(\tau_I, \tau_I)$ for all $h = 1, 2, \dots, H,$
and
- (iii) $c_{2,0}^h(\tau_c, z^h, \tau_I) \geq c_2^h(\tau_I, \tau_I)$ for all $h = 1, 2, \dots, H,$

with at least one strict inequality.

Inequalities (ii) and (iii) in Definition 2 require that no young or old household is made worse off by the transition. Inequality (i) is the intertemporal budget constraint of the government, in which the second and third terms on the left-hand side give the tax revenue net of transfers collected from the initial old generation. Using $\sum_{t=0}^{\infty} (1+r)^{-t} = (1+r)/r$, one notices that the first term on the left-hand side is the present value of the tax receipts from all future generations and that the right-hand side of the equation is the present value of government expenditures. The use of an intertemporal budget constraint means that the government may issue additional debt during the transition, but Ponzi schemes are ruled out. Conversely, without any restriction on the government's deficit policy, it is clear that, once Definition 2 (i) holds, the government can always choose a path of debt such that it meets its obligations at any point in time.

The first proposition states that static and dynamic Pareto improvements are equivalent if transfers $z^h, h = 1, \dots, H$ to the transition generation are used.

Proposition 1. A dynamically Pareto-improving transition from the income tax to the wage/consumption tax exists if and only if there is a wage/consumption tax that statically Pareto dominates the income tax.

Proof. *If:* Let τ_y be the combined rate of a statically Pareto-dominating wage/consumption tax. Choose $\tau_w = 0$, $\tau_c = \tau_y$, and transfers such that

$$(1 - \tau_c)z^h = \tau_c(1 + r)s_I^h(\tau_I) - \tau_I r s_I^h(\tau_I). \quad (7)$$

Inserting (7) in $c_{2,0}^h(\tau_c, z^h, \tau_I)$ yields $c_{2,0}^h = c_2^h(\tau_I, \tau_I)$ and hence Definition 2 (iii). Statement (ii) in Definition 1 implies Definition 2 (ii) with at least one strict inequality. To see inequality (i) in Definition 2, add (3) for $t = 0, 1, \dots$ after appropriate discounting to obtain

$$\frac{1+r}{r}T(\tau_I, \tau_I) + \sum_{h=1}^H \tau_I r s_I^h(\tau_I) = \frac{1+r}{r}b. \quad (8)$$

From inserting (7) in $\tau_c[(1 + r)s_I^h(\tau_I) + z^h] - z^h$, it follows that the latter is equal to $\tau_I r s_I^h(\tau_I)$. From this and Definition 1 (i), (8) implies Definition 2 (i).

Only if: Let τ_w , τ_c , and z^h , $h = 1, \dots, H$ be a dynamically Pareto-improving tax reform. Then, Definition 2 (i) and (iii) together imply

$$0 \leq \frac{1+r}{r}T(\tau_w + \tau_c(1 - \tau_w), 0) \quad (9)$$

$$+ \tau_c \sum_{h=1}^H [(1 + r)s_I^h(\tau_I) + z^h] - \sum_{h=1}^H z^h - \frac{1+r}{r}b \quad (10)$$

$$\leq \frac{1+r}{r}T(\tau_w + \tau_c(1 - \tau_w), 0) + \tau_I \sum_{h=1}^H r s_I^h(\tau_I) - \frac{1+r}{r}b \quad (11)$$

$$= \frac{1+r}{r}[T(\tau_w + \tau_c(1 - \tau_w), 0) - T(\tau_I, \tau_I)],$$

where the third line follows from (8). Hence, $\tau_y = \tau_w + \tau_c(1 - \tau_w)$ satisfies Definition 1 (i). From Definition 2 (ii), also Definition 1 (ii) holds. Now, if in Definition 2 there is a strict inequality in (ii), there is a strict inequality in Definition 1 (ii). If, in Definition 2, we have a strict inequality in (i) or (iii), then there is a strict inequality in (10) or (11), implying $T(\tau_w + \tau_c(1 - \tau_w), 0) > T(\tau_I, \tau_I)$. In each case, it follows that in Definition 1 (i) or (ii), there is at least one strict inequality. ■

Proposition 1 shows that also in an intergenerational context, only the static distortions matter. Whenever the consumption tax dominates

the income tax in a static model, then it can also be implemented in an intertemporal economy without hurting the transition generation. Conversely, the implicit lump-sum tax on old capital does not provide any additional welfare gain if the transition generation has to be compensated out of consumption tax revenues.

The following proposition gives examples for transfers z^h , which implement a Pareto-improving tax reform.

Proposition 2. Given a wage/consumption tax at combined rate τ_y , which statically Pareto dominates the income tax at rate τ_I , a dynamic Pareto improvement can be achieved by

- (i) $\tau_c = \tau_y$, $\tau_w = 0$, and $z^h = s_I^h(\tau_I)[(1+r)\tau_c - r\tau_I]/(1-\tau_c)$ for all $h = 1, \dots, H$,
- (ii) $\tau_c = 0$, $\tau_w = \tau_y$, and $z^h = -\tau_I r s_I^h(\tau_I)$ for all $h = 1, \dots, H$,
- (iii) $\tau_c = [r/(1+r)]\tau_I$, $\tau_w = (\tau_y - \tau_c)/(1-\tau_c)$, and $z^h = 0$ for all $h = 1, \dots, H$.

Proof. Case (i) has been shown in the proof of the “if” part of Proposition 1. The proof of the other cases proceeds in the same way, using the values for τ_w , τ_c , and z^h specified in (ii) and (iii), respectively. ■

Case (i) of Proposition 2 describes the transition to a pure consumption tax, where the wage tax is not employed. Each member of the old generation obtains a transfer (net of consumption tax) that covers the difference between the implicit capital levy and the interest income tax that was due under the old income tax regime. This implies that the old individual is as well off as before and that his or her net payment to the government remains unchanged. Also, the young generation pays the same present value of taxes, but part of this is deferred to Period 1 because savings are exempt from consumption tax. For that reason, in the transition period, the government has to issue new debt. However, this additional debt can be serviced out of higher tax revenues in all future periods.

The transfers in case (i) have several desirable properties. First, we have

Corollary 1. If the aggregate tax revenue function $T(\tau_y, \tau_r)$ is strictly increasing in both tax rates for $\tau_y, \tau_r \leq \tau_I$, then the transfers according to Proposition 2 (i) are nonnegative for all types of households $h = 1, 2, \dots, H$.

Proof. From $s_I^h(\tau_I) \geq 0$, the transfer z^h is nonnegative if $\tau_c(1+r) - \tau_I r \geq 0$. This is satisfied if $\tau_c \geq \tau_I$. To see this, observe that with $\tau_c < \tau_I$, strict monotonicity of the aggregate tax revenue would imply $T(\tau_c, 0) < T(\tau_I, \tau_I)$, contradicting Definition 1 (i). ■

Thus, the transfers are not another set of taxes, which may be helpful politically because it may be difficult to impose additional taxes on the old generation. Moreover, the transfers derive from an anonymous rule applying the same subsidy rate to each individual's savings. Finally, the government can compute the transfers using only information on the interest rate, the tax rates, and the assets held by retirees. This information was already available from implementing the interest income tax.

The transition to a pure wage tax in which consumption is not taxed is described by case (ii) of Proposition 2. This tax reform is beneficial for the old generation because they do not work anymore. Balancing the government budget, however, requires that they pay the same amount of taxes as before. In this case, the transfers are therefore negative. In fact, the z^h 's are the interest income tax that was just abolished. Thus, a way to implement this tax reform is to postpone the abolition of the interest income tax for one period while already raising the wage tax rate to its level in the new steady state.

The transition can also be effectuated without any explicit transfers being paid to the old generation. This is achieved by a combination of the wage tax and the consumption tax, as given in case (iii) of Proposition 2. The mix of both tax rates exactly balances the loss due to the capital levy from the consumption tax and the gain from the fact that pensioners do not pay wage tax.

4. CONCLUSION

This article shows that only a comparison between static distortions matters for the question whether a Pareto-improving transition from income to consumption or wage taxation exists. The capital levy implicit in a newly introduced consumption tax does not provide any additional welfare gain if asset holders have to be compensated out of the general government budget. Furthermore, it is argued that,

using the same information as available under the income tax, the compensation can be realized in various ways such that even additional restrictions concerning the sign of potential transfers do not matter for the result.

NOTES

1. For example, Australia in 2000 reduced the personal income tax and made up the revenue by introducing a goods and services tax (Australian Taxation Office 2000, 3). Also, in Switzerland, such a reform is discussed (Eidgenössische Steuerverwaltung 2001, 69). Since 2002, Germany has exempted the contributions to specific pension-related savings schemes from income tax and at the same time fully taxes the pensions received from such schemes (Bundesministerium der Finanzen 2001, 14). In the United States, Senators Domenici, Nunn, and Kerrey in 1995 proposed a bill to introduce a consumption tax under the name of the Unlimited Savings Allowance (USA) Tax (Nunn 1995).

2. Recent simulations of the quantitative effects are provided by Auerbach (1996) and Altig et al. (2001) for the United States and by Fehr (1999) for Germany. Boadway (1990), Bradford (1996), and Metcalf (1996) discuss the transition issue.

3. For example, a pension reform may be Pareto improving if it alleviates a distortion on the labor market (see Homburg 1990; Fenge and Schwager 1995).

4. Provided that $1 - \tau_c = 1/(1 + \theta)$ holds, this formulation is equivalent to the more common formulation with a tax rate θ applied to the tax-exclusive base c_1 or, respectively, c_2 .

5. Of course, this does not hold in general. A sufficient condition is provided by preferences such that the elasticities of the compensated demand for consumption in both periods with respect to the price of leisure are identical.

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