Coordinating Capital Income Taxation among a Subset of Countries*

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Abstract

Tax competition among countries generally leads to inefficiently low tax rates on mobile tax bases like capital income. This should call for cooperative tax policies to be implemented, but as long as some countries do not take part in the cooperation the incentives for a subset of countries to undertake cooperative action may be limited. The outcome of such "partial cooperation" is derived within a linear-quadratic tax competition model, and the results suggest that positive, but insignificant welfare effects are to be reaped for the participating countries (the main benefits accruing to the countries not participating). The implications of these results for EU-policies on capital income taxation are briefly discussed.

Keywords: Capital income taxation, tax competition, tax cooperation.

JEL: H21, H26, F21.

1. Introduction

The theoretical literature on international tax competition has established that in a world with highly integrated capital markets non-cooperative taxation of capital income is likely to be inefficient from a world economy point of view, and that cooperative tax policies are warranted (see e.g. Bucovetsky and Wilson

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(1991), Gordon (1992), Wilson (1986, 1991) and Zodrow and Mieszkowski (1986)). By investing abroad investors can effectively escape domestic taxation, putting severe restraints on the incentives of a single country to set high taxes on capital income. Hence, capital flight is at the heart of this theory. As noted by Razin and Sadka (1991), capital flight can be prevented if the tax authorities in the different countries agree to exchange information on foreign source capital income. To be fully effective, however, all countries in the world economy must participate in the sharing of information, since otherwise capital flight into the non-participating countries is still viable. In the extreme case with cooperation among only two small economies taking the world rate of return to capital as given Razin and Sadka (1991) have shown that such policy cooperation is useless since the investors in the two cooperating countries can still obtain the world rate of return by investing in some country not participating in the cooperation. Hence, the gains from cooperation may be rather small, at least when the cooperating countries are small themselves.

Another potentially important aspect of tax cooperation is the "importance of being small" in tax competition following Wilson (1991), who in a two-country setting shows that the small country will always be better off than the large country. Since cooperation is like becoming bigger this may be a downside for the cooperating countries as long as tax competition *vis-á-vis* the non-participating countries takes place. The question is whether the "size-effect" may be so dominant that partial cooperation becomes outright detrimental to the cooperating countries.

These theoretical considerations are of particular importance for the current discussions about harmonizing capital income taxation within the European Union. Proponents of capital income tax harmonization within the EU argue in favour of such cooperation[1] by emphasizing the benefits from reduced tax competition. Although it invariably will be true that cooperation will reduce (or even fully remove) tax competition within the EU, the proponents of tax cooperation seem to overlook that capital can still flow outside the EU such that the capital flight problem persists.

The purpose of this paper is to analyze these interesting theoretical aspects that seem to be relevant to the discussion of tax cooperation within the EU. To this end we set up a general equilibrium model of a N-country world economy. Without imposing restrictive assumptions on the functional forms describing preferences

[1] In principle, harmonization and cooperation are two distinct concepts with harmonization as the weaker concept where the dispersion in the non-cooperative tax rates is reduced. Cooperation is a stronger concept that can either imply joint welfare maximization for the individual countries or bargaining over tax rates by individual countries taking the non-cooperative equilibrium as the fall-back position (see e.g. Rasmussen (1992) in a different setting).

and technologies we illustrate the general aspects of tax competition, and the benefits of global tax cooperation. To derive results more closely related to the European policy discussion a simplified version of the model is proposed, allowing us to address some of the questions raised above. Although one should hesitate to interpret these results too widely, our results seem to indicate two things. First, in case not all countries participate in the policy cooperation there appears to be no adverse effects on the countries participating in the cooperation, although there is a tendency for the countries not participating to obtain a larger welfare gain than those actually participating in the cooperation. Second, the gains from cooperation among a subset of countries (relative to full non-cooperation) appear to be rather insignificant, unless the number of non-cooperating countries becomes small compared to the number of cooperating countries. Hence, our analysis do not indicate that the EU countries should be warned against cooperating in capital income taxation, whilst at the same time suggesting that the gains from doing so may be very limited. Moreover, since a marginal country will lose from joining the cooperating countries it could be argued that any agreements within the EU to cooperate in capital income taxation should be enforced on all member countries to avoid free riding.[2]

The paper is organized as follows. In section 2 the general model is set up and non-cooperative and cooperative tax policies are derived and compared. Section 3 deals with the simplified model allowing a subset of countries to cooperate on tax policies. The interpretation of these results for the EU is provided in section 4 while some concluding remarks are given in section 5.

2. The General Model

As a general tax competition model, consider a two-period model of a world economy consisting of N independent countries (indexed by i) producing a homogenous good using capital and labour (the model is a straightforward extension of the model by Wilson (1991) to a two-period framework). In the first period no production takes place while households allocate a fixed endowment towards consumption or capital formation (saving). In the second period firms combine capital and labour to produce output. Labour is supplied inelastically by households and is immobile across countries while capital is perfectly mobile.

[2] This is a variant of the usual argument that a cooperative equilibrium is not a Nash equilibrium in the sense that the countries are not playing best responses in the cooperative equilibrium. However, if a group of countries simultaneously joins the policy cooperation, the joining countries will be become better off if the group is sufficiently big.

2.1. Taxes

Two kinds of taxes are distinguished, a source-based tax on firms' use of capital, t^i, and a residence-based capital income tax, T^i. The availability of these taxes depends on the institutional setting for tax policies where e.g. a pure residence tax on capital income requires a minimal amount of cooperation among all the N countries to share information on capital income of non-residents. As shown by Bacchetta and Espinosa (1995) full information sharing and application of the residence principle in all countries is a cooperative equilibrium as long as countries are identical. However, if either not all countries participate in the information sharing or there are some fundamental asymmetries among the countries (e.g. with respect to size or initial endowments) the residence principle can no longer be applied effectively.[3] Since labour supply is inelastic and we do not want to consider lump sum taxes, labour income is assumed to be untaxed.

2.2. Firms

The representative firm in each country operates in a competitive world market. The price of output is normalized at unity. Since the production function exhibits constant returns to scale we can express output in country i, y^i, as a function of the capital-labour ratio, k^i

$$y^i = f(k^i), \quad f(0) = 0, \quad f'(k^i) > 0, \quad f''(k^i) < 0.$$

Profit maximizing choices of capital and labour, and zero pure profits imply that

$$\begin{aligned} f'(k^i) &= r^i = R + t^i \\ f(k^i) - f'(k^i)k^i &= w^i, \end{aligned}$$

where R is the world rate of return to capital, r^i is the cost of capital to firms and w^i is the wage rate. Hence, the demand for capital and the wage rate are functions of the cost of capital

$$\begin{aligned} k^i &= k(R + t^i) = k(r^i) \\ w^i &= w(R + t^i) = w(r^i), \end{aligned}$$

with $k'(r^i) = \frac{1}{f''(k(r^i))} < 0$, and $w'(r^i) = -k(r^i) < 0$ ($w(r^i)$ is simply the factor price frontier).

[3] In this case capital flight prevents effective use of the residence principle in capital income taxation, an assumption which is often used in this literature, see e.g. Wilson (1991).

2.3. Households

Household utility depends on consumption of private goods in both periods, c^i in period 1 and C^i in period 2, and from the provision of the public good (in the second period) g^i:

$$U^i = u(c^i, C^i) + z(g^i),$$

where the private utility function $u(\cdot)$ is assumed to be twice continuously differentiable, strictly increasing in c^i and C^i and strictly quasi concave. The subutility function $z(\cdot)$ is strictly increasing and concave in g^i. Each household is born with a fixed endowment of goods, e^i, to be allocated to first period consumption and saving while they supply one unit of labour inelastically in the second period. The households themselves are immobile whereas their savings may be invested either at home or abroad. The present value budget constraint of the representative household is

$$C^i = \left(1 + \rho^i\right)\left(e^i - c^i\right) + w^i,$$

where $\rho^i = R - T^i$ is the after-tax return to saving. Solving the utility maximization problem yields the standard consumption demand functions, $c^i = c(\rho^i, w^i)$ and $C^i = C(\rho^i, w^i)$ from which the indirect private utility function follows,

$$v^i = u(c(\rho^i, w^i), C(\rho^i, w^i)) = v(\rho^i, w^i).$$

Consumption in both periods are assumed to be normal, i.e. $c_{w^i} > 0$ and $C_{w^i} > 0$. For later use savings can be derived from Roy's identity to be

$$s^i = s(\rho^i, w^i) \equiv e^i - c(\rho^i, w^i) = \frac{v_{\rho^i}}{v_{w^i}},$$

implying that

$$v_{\rho^i} - s^i v_{w^i} = 0. \tag{2.1}$$

Letting $\widetilde{c}(\rho^i, u)$ denote compensated demand in period 1, the Slutsky equation for period 1 consumption reads

$$c_{\rho^i} = \widetilde{c}_{\rho^i} + s^i c_{w^i}, \tag{2.2}$$

where $\widetilde{c}_{\rho^i} < 0$.

2.4. Governments

Governments use tax revenues to finance expenditures on the public good, and the government budget constraint of country i reads

$$g^i = t^i k(R + t^i) + T^i\left(e^i - c\left(R - T^i, w\left(R + t_i\right)\right)\right).$$

2.5. Equilibrium

Equilibrium in the international capital market requires that the demand for capital equals the supply of capital, i.e.

$$\sum_{i=1}^{N} L^i k(R+t^i) = \sum_{i=1}^{N} L^i \left(e^i - c(R-T^i, w(R+t^i)\right),$$

determining an equilibrium world rate of return as a function of the various tax rates, $R = R(t,T)$, where $t = \left(t^1, ..., t^N\right)$ and $T = (T^1, ..., T^N)$ are the vectors of the world tax rates.[4] Then, we can write equilibrium capital stocks and wages as functions of the tax vectors, $k^i = k(t,T)$ and $w^i = w\,(t,T)$. Moreover, for future use we define $t^{-i} = (t^1, ..., t^{i-1}, t^{i+1}, ..., t^N)$ and $T^{-i} = (T^1, ..., T^{i-1}, T^{i+1}, ..., T^N)$.

2.6. Efficiency

As long as only distortionary taxes are available any cooperative or non-cooperative equilibrium will be inefficient relative to the first-best solution which obtains when, say, lump sum taxes on labour income are available. To characterize the first-best solution we solve the optimal tax problem when all government expenditures are financed through a tax, τ^i, on labour income (for simplicity all countries are assumed to be identical):

$$\begin{aligned}
\max_{\tau^i} V^i &= v(R, w(R) - \tau^i) + z(g^i) \\
&\quad s.t. \\
\sum_{i=1}^{N} k(R) &= \sum_{i=1}^{N} e^i - c(R, w(R) - \tau^i)) \\
g^i &= \tau^i \\
&\quad \tau^{-i} \;\; given.
\end{aligned}$$

The first-order condition is

$$\frac{\partial V^i}{\partial \tau^i} = v_{\rho^i} \frac{\partial R}{\partial \tau^i} + v_{w^i} w'(r^i) \frac{\partial R}{\partial \tau^i} - v_{w^i} + z'(g^i) = 0.$$

Using that in a symmetric equilibrium no net capital flows persist, $s^i = k^i$, such that $w'(r^i) = -s^i$, we can use 2.1 to rewrite the first-order condition for taxes

$$-v_{w^i} + z'(g^i) = 0,$$

[4] The equilibrium world rate of return depends, of course, also on the first period endowments. These are suppressed, for simplicity.

so noting that the marginal rate of substitution between the public good, g^i, and private income, w^i, is $MRS^i = \frac{z'(g^i)}{v_{w^i}}$ we arrive at the condition for efficient supply of the public good

$$MRS^i = 1.$$

Intuitively, this just states that the marginal rate of transformation (equal to 1 since we have a one good model) should equal the marginal rate of substitution.

2.7. Tax Competition

Consider first the case of a symmetric world economy where the N countries are identical (setting $L^i = 1,\ i = 1, ..., N)$, and let tax policies be set non-cooperatively. Following the literature on tax competition this implies that residence-based taxation of capital income is not viable, $T^i \equiv 0$. The optimal tax problem of a country i is then

$$\begin{aligned} \max_{t^i} V^i &= v(R, w(R+t^i)) + z(g^i) \\ & \quad s.t. \\ \sum_{i=1}^{N} k(R+t^i) &= \sum_{i=1}^{N} e^i - c(R, w(R+t^i)) \\ g^i &= t^i k(R+t^i) \\ & \quad t^{-i}\ \ given. \end{aligned}$$

The first-order condition reads

$$\frac{\partial V^i}{\partial t^i} = v_{\rho^i} \frac{\partial R}{\partial t^i} + v_{w^i} w'(r^i) \left(1 + \frac{\partial R}{\partial t^i}\right) + z'(g^i) \left(1 - \varepsilon^i_{k,t}\right) k(r^i) = 0$$

where

$$\varepsilon^i_{k,t} \equiv -\frac{\partial \left(k(R+t^i)\right)}{\partial t^i} \frac{t^i}{k^i} > 0,$$

is the elasticity of the capital stock with respect to the tax rate in country i.[5] Again we can simplify the first-order condition for taxes by using that $s^i = k^i$ in symmetric equilibrium such that

$$-v_{w^i} + z'(g^i) \left(1 - \varepsilon^i_{k,t}\right) = 0,$$

and

$$MRS^i = \frac{1}{1 - \varepsilon^i_{k,t}}. \tag{2.3}$$

[5] For tax revenues to be increasing in t_i this elasticity must be less than one. In the present set up $\varepsilon^i_{k,t}$ may exceed one (or it may even be negative, i.e. $\frac{\partial k_i}{\partial t_i} > 0$) in which case the standard tax competition result fails to hold, see below.

In order to use 2.3 to characterize the equilibrium[6] we need to derive the elasticity of the capital stock with respect to the tax, $\varepsilon^i_{k,t}$ Thus,

$$\varepsilon^i_{k,t} = -\frac{k'(r^i)t^i}{k_i}\left(1 + \frac{\partial R}{\partial t^i}\right),$$

where $\frac{\partial R}{\partial t^i}$ can be derived from the capital market equilibrium condition:

$$\frac{\partial R}{\partial t^i} = -\frac{k'(r^i) + c_{w^i}w'(r^i)}{N\left(k'(r^i) + c_{\rho^i} + c_{w^i}w'(r^i)\right)}.$$

Evaluating in the symmetric equilibrium (where $k^i = s^i$ and $w'(r^i) = -s^i$) and using the Slutsky equation 2.2 we obtain

$$\frac{\partial R}{\partial t^i} = -\frac{k'(r^i) - k^i c_{w^i}}{N\left(k'(r^i) + \widetilde{c}_{\rho^i}\right)} < 0.$$

Finally, we obtain

$$\varepsilon^i_{k,t} = -\frac{k'(r^i)t^i\left[(N-1)\,k'(r^i) + N\widetilde{c}_{\rho^i} + k^i c_{w^i}\right]}{N\left(k'(r^i) + \widetilde{c}_{\rho^i}\right)k_i}.$$

The denominator is strictly negative while the numerator cannot be signed unambiguously. Of the terms inside the bracket in the numerator the first two are negative (and increasing numerically with the number of countries, N) while the last term is positive. Hence, unless there is a strong income effect in first-period consumption or the number of countries is small, the overall sign of $\varepsilon^i_{k,t}$ is positive. For a positive $\varepsilon^i_{k,t}$ it may be smaller or larger than unity. Thus, three qualitatively different equilibria may be obtained. First, the standard tax competition result obtains when $0 < \varepsilon^i_{k,t} < 1$, in which case $MRS^i > 1$ and the public good is underprovided relative to the first-best. Second, if $\varepsilon^i_{k,t} > 1$ no interior solution exists as $\frac{\partial V^i}{\partial t^i} < 0$ and $t^i = g^i = 0$.[7] Finally, if $\varepsilon^i_{k,t} < 0$ then $MRS^i < 1$ and the public good is overprovided relative to the first-best.

[6] It is well known in this literature that existence and uniqueness of equilibrium may fail to hold unless further restrictions are imposed on preferences and technologies, see Wilson (1991). For the sake of the argument we assume a unique equilibrium exists.

[7] Notice, that this seems rather unlikely as it requires that the Laffer-curve is negatively sloped at $t^i = 0$. For this reason it seems reasonable to assume that the economy is on the rising part of the Laffer-curve at the optimum.

2.8. Cooperative Tax Policies

The simple case of cooperative tax policies obtains when all N countries take part in the cooperation. In that case the optimal tax problem can be written as

$$\begin{aligned} \max_t V &= v(R, w(R+t)) + z(g) \\ & \quad s.t. \\ k(R+t) &= e^i - c(R, w(R+t)) \\ g &= tk(R+t), \end{aligned}$$

where t is the common capital income tax rate. The first-order condition can still be expressed in the form

$$MRS^{coop} = \frac{1}{1 - \varepsilon_{k,t}^{coop}}, \tag{2.4}$$

where

$$\varepsilon_{k,t}^{coop} = -\frac{k'(r)t\left[\widetilde{c}_\rho + kc_w\right]}{\left(k'(r) + \widetilde{c}_\rho\right)k}.$$

Assuming $0 < \varepsilon_{k,t}^{coop} < 1$ it follows that $\varepsilon_{k,t}^{coop} > \varepsilon_{k,t}^{i}$ and hence that

$$MRS^i > MRS^{coop} > 1,$$

revealing that the cooperative solution involves less "underprovision" of the public good than under non-cooperative tax policies. However, since savings are still being distorted by the capital income tax we remain in a second-best situation.

3. A Specific Model

Unfortunately, there is little hope for obtaining general results when the symmetric multi-country set-up is abandoned.[8] Therefore, we now present a simplified version of the model (see Bucovetsky (1991) for a similar specific model in a two-country set-up). First, the model is static, making the level of savings exogenously equal to the endowments of capital. Secondly, specific functional forms for preferences and technologies are used. To concentrate on the implications of asymmetries in the extent of cooperation, all countries are assumed to be identical and $L^i = 1$, for simplicity, for all i.

[8] Wilson (1991) contains some quite general results for the two-country case with asymmetries (although existence and uniqueness of equilibrium is merely assumed without giving much insight into what basic assumptions are needed for that to carry through). For the multi-country case there seems to be no general results available when asymmetries are present.

3.1. Taxes

Since the level of savings is exogenous in this version of the model a residence-based capital income tax is a lump-sum tax. As in the previous section residence taxation is only available when all countries agree to cooperate on sharing information on capital income of non-residents.[9] However, as we concentrate on cases with partial cooperation where residence taxation cannot be applied in its pure form, source-based capital income taxes, t^i, are the only ones available.

3.2. Firms

The production function is assumed to be quadratic in the capital-labour ratio:

$$y^i = \left(\alpha - \beta k^i\right) k^i,$$

with $\alpha > 0$, $\beta > 0$ and $\alpha - 2\beta k^i > 0$ for all possible values of k^i (implying a positive marginal product of capital). The demand for capital becomes

$$k^i = \frac{\alpha - (R + t^i)}{2\beta}, \tag{3.1}$$

while the wage becomes

$$w^i = \beta \left(k^i\right)^2.$$

3.3. Households

Households are endowed with one unit of capital to be invested at home or abroad. The utility function is assumed to be linear with a constant marginal rate of substitution between private goods, c^i, and public goods, g^i

$$U^i = c^i + \theta g^i,$$

where $\theta > 1$.[10] The budget constraint reads

$$c^i = w^i + R,$$

(since there is no residence taxation) such that the semi-indirect utility function becomes

$$V^i = w^i + R + \theta g^i.$$

[9] This implies that with cooperation among all countries the first best equilibrium can be obtained.

[10] An interior solution with positive values of both private and public consumption generally exists with $\theta > 1$ since the public good is financed through a distortionary tax. With lump sum taxes a corner solution with $g^i = w^i + R$ and $c^i = 0$ follows. If $\theta \leq 1$ no public goods should be provided.

3.4. Governments

The government budget constraint of country i reads

$$g^i = t^i k^i.$$

3.5. Equilibrium

Equilibrium in the international capital market requires that (remember that $L^i = 1$ for all i)

$$\sum_{j=1}^{N} k^j = N,$$

so using equation 3.1 the equilibrium world rate of return becomes[11]

$$R = \alpha - 2\beta - \frac{\sum_{j=1}^{N} t^j}{N}.$$

3.6. Tax Competition

The non-cooperative equilibrium taxes can be explicitly derived for this model.[12] Each country chooses its tax, t^i, to maximize utility of the representative consumer subject to the relevant constraints

$$\begin{aligned} \max_{t^i} V^i &= w^i + R + \theta t^i k^i \\ & \quad s.t. \\ R &= \alpha - 2\beta - \frac{\sum_{j=1}^{N} t^j}{N} \\ k^i &= \frac{\alpha - (R + t^i)}{2\beta} \\ w^i &= \beta \left(k^i\right)^2 \\ & \quad t^{-i} \ \ given. \end{aligned}$$

The first-order condition reads

$$\frac{\partial V^i}{\partial t^i} = 2\beta k^i \frac{\partial k^i}{\partial t^i} + \frac{\partial R}{\partial t^i} + \theta \left(k^i + t^i \frac{\partial k^i}{\partial t^i} \right) = 0.$$

[11] It is implicitly assumed that in equilibrium $R \geq 0$. This just requires that α is sufficiently large (α does not affect the equilibrium taxes).

[12] Existence of a Nash equilibrium to such a game is guarateed if the utility functions are continuous and quasi-concave (in taxes) and the strategy sets are compact and convex (see Bucovetsky (1991) and vanYpersele (1998)). These conditions are fulfilled for our choice of functional forms.

Noticing that

$$\begin{aligned}\frac{\partial k^i}{\partial t^i} &= -\frac{N-1}{N}\frac{1}{2\beta} \\ \frac{\partial R}{\partial t^i} &= -\frac{1}{N},\end{aligned}$$

the symmetric equilibrium tax rate under tax competition (non-cooperation), t^{NC}, becomes

$$t^{NC} = \frac{2\beta N(\theta-1)}{\theta(N-1)}.$$

While this non-cooperative equilibrium may not be that interesting in itself, it is a useful reference point to compare with when we now consider equilibria with partial cooperation.

3.7. Partial Cooperation

To analyze the effects of cooperation among a subset of the N countries, we let $M < N$ denote the number of countries taking part in the cooperation while the remaining $N - M$ countries are assumed to act non-cooperatively. To be specific, since the M countries cooperating are identical the same tax t^M applies in these countries. The equilibrium tax applying in the non-cooperating countries is simply denoted t.

For each of the non-cooperating countries, $i \in \{M+1, M+2, ..., N\}$, the optimal tax problem reads

$$\begin{aligned}\max_{t^i} V^i &= w^i + R + \theta t^i k^i \\ &\quad s.t. \\ R &= \alpha - 2\beta - \frac{\sum_{j=1}^{N} t^j}{N} \\ k^i &= \frac{\alpha - (R + t^i)}{2\beta} \\ w^i &= \beta\left(k^i\right)^2 \\ &\quad t^{-i} \ \ given,\end{aligned}$$

which is identical to the optimal tax problem under tax competition. Hence, the first-order condition still reads

$$\frac{\partial V^i}{\partial t^i} = 2\beta k^i \frac{\partial k^i}{\partial t^i} + \frac{\partial R}{\partial t^i} + \theta\left(k^i + t^i \frac{\partial k^i}{\partial t^i}\right) = 0. \tag{3.2}$$

However, for the M cooperating countries matters are a little different as they as a whole have got more "market power" in the international capital market than a single non-cooperating country. Hence, the optimal tax problem for the cooperating countries reads[13]

$$\begin{aligned}
\max_{t^M} V^M &= w^M + R + \theta t^M k^M \\
&\quad s.t. \\
R &= \alpha - 2\beta - \frac{Mt^M + (N-M)\,t}{N} \\
k^M &= \frac{\alpha - \left(R + t^M\right)}{2\beta} \\
w^M &= \beta \left(k^M\right)^2 \\
&\quad t \ \ given.
\end{aligned}$$

The first-order condition reads

$$\frac{\partial V^M}{\partial t^M} = 2\beta k^M \frac{\partial k^M}{\partial t^M} + \frac{\partial R}{\partial t^M} + \theta \left(k^M + t^M \frac{\partial k^M}{\partial t^M} \right) = 0. \tag{3.3}$$

The main difference between the two first-order conditions, 3.2 and 3.3, is the size of the derivative of the world rate of return with respect to the taxes:

$$\begin{aligned}
\frac{\partial R}{\partial t^i} &= -\frac{1}{N} \\
\frac{\partial R}{\partial t^M} &= -\frac{M}{N}
\end{aligned}$$

implying that a change in the tax in the cooperating countries has a larger effect on the world rate of return than a tax change in a single non-cooperating country has (reflecting the differences in "market power"). Solving the first-order conditions leads (after some tedious manipulations) to the equilibrium taxes:

$$\begin{aligned}
t^M &= \frac{2\beta(\theta-1)\left[\theta N(2N-1) - (N-M)^2 - M(N-1)\right]}{\theta(N-M)\left[\theta(2(N-1)+M) - N + 1\right]} \\
t &= \frac{2\beta N^2(\theta-1) + (N(\theta-1)+1)\,Mt^M}{\theta N(N+M-1) - M(N-1)}.
\end{aligned}$$

Although it is possible to obtain an analytical solution for the two taxes, the expressions are so complex that they are not very helpful for characterizing equilibrium. Moreover, what we basically are interested in is the welfare level in the

[13] For simplicity, the equilibrium tax of the non-cooperating countries, t (yet to be determined), is inserted in the expression for the equilibrium world rate of return.

various countries in the different equilibria, and although it is possible to obtain explicit analytical expressions for the equilibrium welfare levels there is nothing to be gained from doing so (again, due to the complexity of the expressions). Instead, we illustrate the results through a numerical example allowing us to focus on the importance of the number of countries participating in the cooperation, M

3.7.1. Numerical Example

In our basic numerical example we choose the following parameter values:

$$N = 100,\ \alpha = 70,\ \beta = 1,\ \theta = 2,$$

while we let M vary between 1 and 99. To get insights into the welfare effects of partial cooperation we measure the utility level relative to the first best outcome (where all output goes to public consumption since $\theta > 1$).[14] In Figure 1 we show the welfare of the cooperating countries for the different levels of cooperation. The figure shows first of all, that the cooperating countries must be a significant part of the world economy for the cooperation to matter quantitatively. E.g. when 50% of the countries cooperate their welfare gain is less than 0.3% compared to the non-cooperative welfare level. This is in line with the result in Razin and Sadka (1991) who show that two small economies that take the world rate of return as given have no incentive to engage in tax cooperation with each other. Secondly, even though there may be a limited welfare gain of partial cooperation there seems to be no risk of partial cooperation being outright detrimental to the participating countries.

In Figure 2 we show how the non-participating countries are affected. Again, there are no significant effects of partial cooperation as long as the participating countries are not a significant part of the world economy. However, for every $M > 1$ the welfare of a non-participating country exceeds the welfare level of the participating countries (this basically confirms the result in Wilson (1991) that small countries tend to win in tax competition). Hence, for a marginal country there is no incentive to participate in cooperation (rather, there are incentives not to participate). Moreover, when only a few countries do not participate these countries are better off than at the first best allocation, due to heavy imports of foreign capital (again confirming results in Wilson (1991)).

[14] The calculations were performed using the Maple facility in Scientific Workplace 3.0.

Figure 1. Utility index of cooperating countries

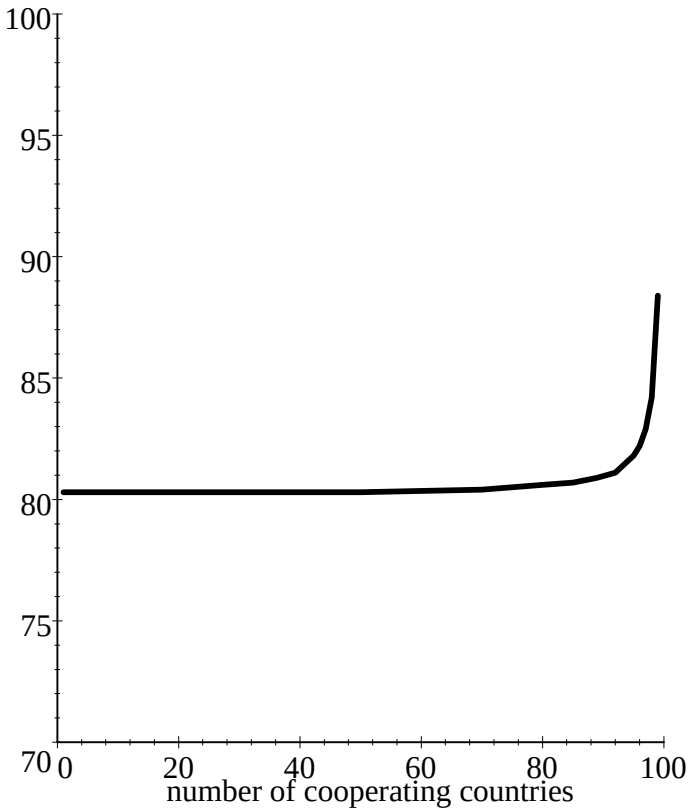
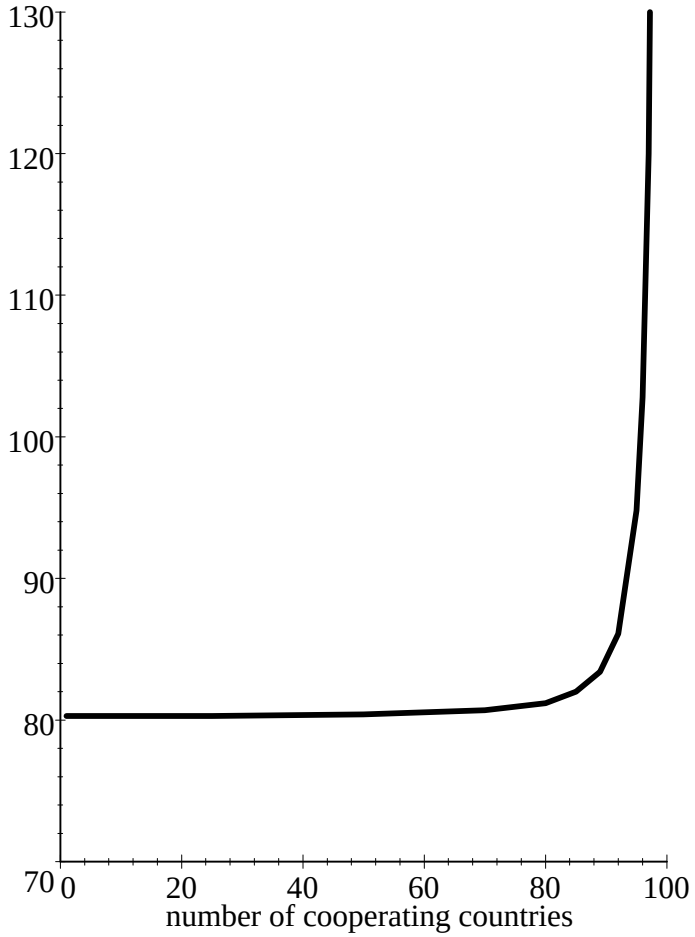


Figure 2. Utility index of non-cooperating countries.



4. Implications for EU Tax cooperation

The current discussions within the EU concerning cooperation of capital income taxation seem to presuppose that the gains from eliminating tax competition among the EU countries are positive and significant.[15] The theoretical literature on tax competition suggests that matters may not be so simple. Of course, if tax

[15] Of course, since the EU countries are heterogeneous such tax coordination will typically affect the various EU countries differently (and some countries may even be hurt), implying that apart from the arguments concerning overall efficiency of tax coordination the question

cooperation could involve the entire world economy it is likely that substantial gains were to be reaped. Cooperation among the EU countries will, however, leave a substantial part of the world economy outside the tax cooperation, and the simple efficiency results of tax cooperation cannot be applied to such partial cooperation. Following Razin and Sadka (1991) one could conjecture that the gains from cooperating among a subset of countries would be insignificant, and our results seem to confirm that conjecture. In fact, the main part of the gains from cooperation within the EU countries could well accrue to the countries outside the EU not participating in the cooperation. This simply reflects that more capital flight from EU-residents to the rest of the world will follow if the EU countries choose to cooperate (since that leads to higher taxes within the EU).

Another theoretical aspect of partial tax cooperation is that cooperation is like increasing the country size of the countries participating, and following Wilson (1991) being large is a disadvantage under tax competition. Hence, at the theoretical level one cannot rule out that strictly adverse effects would follow partial tax cooperation. However, our results do not seem to support such a view. Of course, this may be due to our choice of functional forms for technologies and preferences, implying that adverse effects of partial cooperation cannot be ruled out, in general.

To conclude, the main policy implications of our analysis are as follows. First of all, since any decision in the EU to cooperate on capital income taxation does not involve other major countries in the world economy it seems likely that the welfare effects will be insignificant. That is, even though partial cooperation may not hurt the participating countries the gains are unlikely to be significant. Secondly, a decision within the EU to introduce cooperation on capital income taxation should not allow single countries to abstain from participating, since that could lead to a break down of the whole project when all countries consider the gain from leaving the cooperation on their own.[16]

5. Concluding Remarks

We have proposed a model that might shed light on some of the aspects concerning international cooperation in capital income taxation in general, and for the prospects of such cooperation within the EU. The main result is that the EU could agree to introduce more formally cooperation of capital income taxation without

of distributional effects among the EU countries is also relevant. We concentrate solely on the efficiency effects since our countries are identical.

[16] As noted in footnote 2 it is possible that there is a (small) gain for the cooperating countries when all EU countries participate, even though for a single country it is preferable to leave the cooperation on it own (due to the partial cooperation equilibrium not being a Nash equilibrium).

risking any adverse effects, but at the same time it seems unlikely that the gains from doing so would be large.

Of course, since our results have been derived in a rather specific model, the conclusions should be applied with caution. However, the current setting may be useful to analyze other aspects of EU capital income tax cooperation, like the presence of differences between the EU countries (e.g. with respect to their valuation of public goods provision measured by the parameter θ). Hence, one line of future research should try to introduce such relevant asymmetries among the countries, while another line of future research could attempt to see how far the current results could be generalized.

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