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Strategic Delegation and International Capital Taxation*

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Abstract

The literature on tax competition generally concludes that international coordination of capital taxes among symmetric countries increases tax rates. This paper investigates whether this conclusion also holds in a political economy framework where taxes are set by elected policy makers. It shows that policy makers are fiscally more liberal than the average citizen if taxes are set non-cooperatively. However, fiscally more conservative policy makers are elected if taxes are set cooperatively. The introduction of tax coordination cannot remove the incentive to compete for foreign capital, but simply shifts it to the election stage. The paper proves that with standard specifications of the utility functions, coordination leads to lower tax rates than competition.

Keywords: Tax competition, tax coordination, strategic delegation

JEL classification: H2

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1 Introduction

Capital taxation in open economies attracts an enormous attention among economists and politicians, especially in the European Union. It is a common presumption in this discussion that tax coordination among independent countries leads to higher tax rates on mobile capital compared to non-cooperative tax policies. This paper shows that this presumption is not generally true if the political reactions on different tax regimes are taken into account. Building on a simple symmetric two-country model in which tax rates are set by elected policy-makers, we show that tax coordination can actually lead to lower tax rates than tax competition. Therefore, this paper casts doubts on standard conclusions made in the academic and public discussion on the consequences of worldwide, or European, capital tax coordination.

In the present model, capital taxes are determined in a two stage game. In the first stage, national electorates choose one of their members as policy maker. In the second stage, the elected policy makers set tax rates either competitively or cooperatively. The tax proceeds are used to finance national public goods. In this setting, tax coordination and tax competition affect the voters' choices at the first stage in different ways. Start with considering the case of tax competition. Assume, first, that the national median voters chose the tax rates in the second stage themselves. It is well known that the mobility of the tax base (foreign capital) creates incentives to lower tax rates. This leads to inefficiently low tax rates from an ex-ante view of the median voters. Anticipating this outcome in the first stage, the median voters have an incentive to elect policy makers who care more for the public good (i.e., who are fiscally more liberal) than themselves, if tax policies are delegated to elected politicians. Therefore, the tax decreasing effect of competition is partially offset. Next, consider the case of tax coordination. Under this regime, the two policy makers choose the two tax rates to maximize their joint utility.[1] The incentive for policy makers to attract more capital by lowering the tax rates is removed. However, the same incentive now plays a crucial role for voters in the election stage. By choosing

[1] It should be noted that tax coordination is quite different from tax harmonization where policy makers decide jointly on one tax rate valid in all countries. However, since this paper builds on a symmetric model, it is not well suited for an analysis of this frequently proposed mechanism. In general, tax harmonization includes the cost that countries have identical tax rates despite of differences in financial needs or preferences. Obviously, a symmetric model cannot capture this potential cost.

delegates with rather low preferences for the public good, the national median voters try to achieve (relatively) lower tax rates in the second stage and attract more capital. Therefore, switching from a competitive to a coordinated tax regime replaces one channel for reducing tax rates by another. Moreover, under tax coordination there is no possibility to partly offset this incentive through the political process. This paper demonstrates that with commonly assumed specifications of utility and production functions, implementing tax coordination actually decreases capital tax rates. This holds, e.g., if preferences are log-linear and the production functions are of the Cobb-Douglas type. More general, we show that this result extends to all utility functions for which the relative risk-aversion with respect to public good consumption is greater than one.

The issue of delegation in the presence of tax competition for mobile capital has been investigated before by Persson and Tabellini [10]. They show that elected policy makers are fiscally more liberal than national median voters. This paper can be seen as an extension of their analysis to the case of delegation in a coordination regime. Our analysis builds on the symmetric one-period two-country model for international capital taxation by Wildasin [13]. Capital taxes are used to finance national public goods with no cross-border externalities. However, Wildasin and most of the literature on tax competition assume that taxes are set by benevolent governments.[2] They conclude that tax competition leads to an underprovision of public goods or to inefficiently high tax rates on labor. In a recent paper, Fuest and Huber [6] question the feasibility of tax coordination. They conclude that cooperative agreements are ineffective if they do not include all tax instruments. A similar result can be found in Cremer and Gahvari [3]. They show that countries might strategically choose to allow for tax evasion in order to offset tax increasing effects of tax coordination. Our paper demonstrates that even if tax coordination includes all tax instruments, taxes might nevertheless decrease due to political reactions. The result of socially wasteful tax competition has been questioned by many authors working on optimal taxation. These authors point out that in a dynamic context, capital taxation faces a time-inconsistency problem (see Kehoe [8]). In general, it is optimal to tax installed capital at very high rates, but to set tax rates in the long run equal to zero (see Judd [7] or Chamley [1], for a more general discussion see Chari and Kehoe [2]). Without commitment, this solution is not attainable. Therefore, it

[2]For a recent survey of the literature on tax competition, see Wilson [14].

is often concluded that tax competition is socially preferable to tax coordination since it partially offsets the time-inconsistency problem. However, as the literature on tax competition, this view neglects the fact that tax competition and tax coordination might induce very different political reactions. This also holds for the literature that, based on public choice arguments, replaces the assumption of a benevolent government by a leviathan assumption.[3] Even though this paper deals with the political economy of capital taxation in a static framework, the result of tax rate decreasing tax coordination should also be of importance in a dynamic context.[4] Our result of decreasing capital taxes as consequence of introducing tax cooperation indicates that those proposing tax coordination in order to avoid a race-to-the-bottom might have to reconsider their proposal. However, those who share the opinion that capital is actually taxed too high (e.g., due to a time-inconsistency problem) might benefit from tax coordination among short-sighted politicians.

The remainder of this paper proceeds as follows. The next section presents the model and derives implicit solutions for the equilibrium tax rates in a competitive and in a cooperative tax regime. These solutions hold for general utility and production functions. Moreover, it presents sufficient conditions for an introduction of tax coordination to induce decreasing tax rates. Section 3 considers the above mentioned example of log-linear preferences to further illustrate the tax decreasing effects of international capital tax coordination. Finally, section 4 concludes.

2 The Model

2.1 The Economic Environment

The economy consists of two countries, both inhabited by an infinite number of agents with unit mass. The agents derive utility from the consumption of a private good c and a national public good g. The utility functions are separable, strictly concave and satisfy the Inada-conditions. Each agent inelastically supplies one unit of labor and owns S units

[3]Recent contributions include Edward and Keen [4], Fuest [5] and Rauscher [12].

[4]There exist quite a few contributions of political economy aspects of capital taxation in two period models (see especially Persson and Tabellini [11] and the references therein) and some in dynamic models (e.g., Krusell et al. [9]), albeit almost exclusively for closed economies.

of capital, that can be invested at home or abroad. Capital is perfectly mobile across countries, whereas labor is perfectly immobile. The public goods are financed by a per-unit tax on employed capital K_i, i.e., capital is taxed according to the source principle. The agents are heterogenous with respect to their valuation of the public good. More specifically, the utility function of agent l in country i is given by

$$\begin{aligned} U_{il} &= u(c_{il}) + \alpha_{il} v(g_i) \qquad (1) \\ v'(g), u'(c) &> 0, v''(g), u''(c) < 0, \alpha_{il} \in \Re^{+} \\ c_{il} &= w_i + \rho S \\ g_i &= t_i K_i \end{aligned}$$

Here, ρ is the net (i.e., after tax) return of capital. Due to inelastic labor supply, the only (economic) choice of the households is to decide where to invest. Due to perfect capital mobility, optimal investment behavior of households implies that, in any competitive equilibrium, the after tax return ρ is equal in the two countries. The parameter (or types) α_{il} are continuously distributed and have an identical median value, denoted as β. As described in the introduction, taxes are set by elected policy-makers. Throughout the paper, we will often call them delegates since they act on behalf of their electorates. We will characterize the delegates (policy-makers) by the type indicating their valuation of the public good. For convenience, we denote the type of the delegate in country i as α_i.

Firms in both countries are competitive and have access to an identical production technology exhibiting constant returns to scale,

$$F(K, L) = Lf\left(\frac{K}{L}\right) = f(k) = f(K) \qquad (2)$$

A politico-economic equilibrium in this economy consists of wages w_i, gross interest rates r_i, per capita investments (capital) k_i, taxes t_i and delegates α_i. When making their decisions, private agents take the politically determined tax rates in both countries as given.[5] It is straightforward to see that the equilibrium values determined in the private sector fulfill[6]

$$w_i = f(k_i) - k_i f'(k_i) \qquad (3)$$

[5] Note that the type of delegates only indirectly affects utility and profit functions.

[6] As in most of the literature, we do not impose any bound on tax rates. Hence, we implicitly exclude free disposal of capital. However, the main results of this paper do not depend on this simplifying assumption.

$$
\begin{aligned}
r_i &= f'(k_i) & (4)\\
k_i + k_j &= 2S & (5)\\
\rho &= r_i - t_i = r_j - t_j & (6)
\end{aligned}
$$

In (6), ρ denotes the after-tax-return of capital, that is equalized among countries due to free capital mobility. In the next subsection, we turn to the politically determined equilibrium taxes t_i, chosen by the delegates in the second stage of the tax game. Depending on the regime, taxes are set either non-cooperatively or cooperatively. Subsequently, we determine the equilibrium types of the delegates α_i. The delegates are chosen by majority voting within each country. However, instead of explicitly modelling the election process, we will use the fact that the median voter theorem applies in our context.

2.2 Tax Competition and Tax Coordination

We start with the determination of capital taxes in the competitive tax regime. Here, the policy makers (delegates) simultaneously choose the tax rates on capital. For their decision, the delegates anticipate the reactions of the private agents on the chosen tax rates. Therefore, we can insert the equilibrium conditions (3), (4) and (6) into the utility function of a delegate, i.e.,

$$
U_i = u\left(f(k_i) - k_i f'(k_i) + \left(f'(k_i) - t_i\right) S\right) + \alpha_i v(t_i k_i)
$$

Maximizing the utility function with respect to the tax rates results in the following FOC.

$$
\frac{\partial u_i}{\partial c_i}\left(f''(k_i)\frac{\partial k_i}{\partial t_i}(S - k_i) - S\right) + \alpha_i \frac{\partial v_i}{\partial g_i}\left(k_i + t_i \frac{\partial k_i}{\partial t_i}\right) = 0 \qquad (7)
$$

Totally differentiating (5) and (6) and combining the results yields

$$
\begin{aligned}
\frac{\partial k_i}{\partial t_i} &= \frac{1}{f''(k_i) + f''(k_j)} & (8)\\
\frac{\partial k_j}{\partial t_i} &= -\frac{1}{f''(k_i) + f''(k_j)} & (9)
\end{aligned}
$$

For later use, it is convenient to define the (negative) tax elasticity of capital as

$$
\eta = -\frac{\partial k_i}{\partial t_i}\frac{t_i}{k_i} = -\frac{t_i}{k_i}\frac{1}{f''(k_i) + f''(k_j)} > 0
$$

Inserting (8) into (7) shows that, in a symmetric equilibrium, capital taxes are determined by

$$\alpha_i \frac{\partial v_i}{\partial g_i} \left(S + \frac{t_i}{2 f'' (S)} \right) = S \frac{\partial u}{\partial c_i} \tag{10}$$

Since $f''(S) < 0$, (10) implies that the marginal rate of substitution between private and public good consumption is smaller than one for the policy makers. Therefore, the Samuelson condition of equal marginal rates does not hold. In order to see that the tax elasticity affects the equilibrium allocation even though in equilibrium there are no capital movements, we can rewrite (10) as

$$\alpha_i \frac{\partial v_i}{\partial g_i} (1 - \eta) = \frac{\partial u}{\partial c_i} \tag{11}$$

Next, consider the case of tax coordination. Following the literature, tax coordination means that the delegates choose the two tax rates to maximize the sum of their utility functions (see,e.g., Persson and Tabellini [11]). Hence, it is implicitly assumed that the tax setter have access to sidepayments that do neither influence the utility of the electorates nor the tax choice by the delegates. The FOC's of the delegates are then given by

$$\begin{aligned} & \frac{\partial u_i}{\partial c_i} \left(\frac{f''(k_i)}{f''(k_i) + f''(k_j)} (S - k_i) - S \right) + \alpha_i \frac{\partial v_i}{\partial g_i} \left(k_i + \frac{t_i}{f''(k_i) + f''(k_j)} \right) \\ - & \frac{\partial u_j}{\partial c_j} \left(\frac{f''(k_i)}{f''(k_i) + f''(k_j)} (S - k_j) \right) - \alpha_j \frac{\partial v_j}{\partial g_j} \left(\frac{t_j}{f''(k_i) + f''(k_j)} \right) = 0 \end{aligned} \tag{12}$$

In the symmetric case, this expression simplifies to

$$\alpha_i \frac{\partial v_i}{\partial g_i} = \frac{\partial u_i}{\partial c_i} \tag{13}$$

Hence, in equilibrium both delegates equalize their marginal rates of substitution between private and public good consumption. In equilibrium, the tax elasticity does not affect the choices of the delegates. Moreover, any agent would choose higher tax rates in the coordination regime, as it is shown in the previous literature. However, the incentives to strategically choose the policy makers drastically differ among the two regimes. Hence, if one introduces tax coordination, different agents are chosen as policy makers. Therefore, it is a-priori an open question which regime yields higher equilibrium tax rates.

2.3 Delegation and Tax Regimes

Now we turn to the first stage, in which the delegates (policy makers) are chosen. Since preferences are single-peaked, we do not model the political system in great detail. Instead, it is assumed that essentially the national median voters decide on the delegates.[7] Maximizing the utility function of the median voter (or better, of the politically decisive agent) with respect to the type of the delegate yields the following FOC.

$$\begin{aligned} & \frac{\partial u_i}{\partial c_i}\left(f''(k_i)(S-k_i)\left(\frac{\partial k_i}{\partial t_i}\frac{\partial t_i}{\partial \alpha_i}+\frac{\partial k_i}{\partial t_j}\frac{\partial t_j}{\partial \alpha_i}\right)-\frac{\partial t_i}{\partial \alpha_i}S\right) \\ + \quad & \beta\frac{\partial v_i}{\partial g_i}\left(k_i\frac{\partial t_i}{\partial \alpha_i}+t_i\left(\frac{\partial k_i}{\partial t_i}\frac{\partial t_i}{\partial \alpha_i}+\frac{\partial k_i}{\partial t_j}\frac{\partial t_j}{\partial \alpha_i}\right)\right)=0 \end{aligned}$$

Using symmetry, i.e., $k_i = k_j = S$ for $t_i = t_j$, and dividing by $\frac{\partial t_i}{\partial \alpha_i}$ results in

$$\begin{aligned} \beta\frac{\partial v_i}{\partial g_i}\left(S+\frac{t_i}{2f''(S)}\left(1-\frac{\partial t_j}{\partial t_i}\right)\right) &= \frac{\partial u_i}{\partial c_i}S \\ \beta\frac{\partial v_i}{\partial g_i}\left(1-\eta\left(1-\frac{\partial t_j}{\partial t_i}\right)\right) &= \frac{\partial u_i}{\partial c_i} \end{aligned} \tag{14}$$

These equations are valid for both tax regimes. However, the induced reaction functions $\frac{\partial t_j}{\partial t_i}$ differ between the two regimes because both foreign and home tax rates depend differently on the elected delegate. Therefore, different tax regimes lead to the election of different policy-makers. If we combine (14) with (10), we can see that the policy maker in the competitive tax regime is implicitly given by

$$\alpha_i = \beta\frac{1-\eta\left(1-\frac{\partial t_j}{\partial t_i}\right)}{1-\eta} \tag{15}$$

It should be emphasized that both the elasticity η and the reaction curve $\frac{\partial t_j}{\partial t_i}$ are functions of α_i. In case of a cooperative tax regime, combining (14) with (13) yields

$$\alpha_i = \beta\left(1-\eta\left(1-\frac{\partial t_j}{\partial t_i}\right)\right) \tag{16}$$

Condition (16) reveals that the equilibrium allocation crucially depends on the elasticity η even in the cooperative tax regime, since it affects the selection of delegates by the political decisive agents.

[7]However, the central results of this paper do not depend on the validity of the median voter hypothesis. It is also possible to interpret β, the median of the distribution of types in a country, as type of the government. In such a context, β can be the outcome of a political bargaining game among different parties.

Most economists find that taxes are strategic complements, i.e., $\frac{\partial t_j}{\partial t_i} > 0$, at least if the countries are sufficiently symmetric. Under this condition, (15) shows that in the competitive regime the policy maker likes the public good more than the median voter, i.e. $\alpha_i > \beta$. Since $\frac{\partial t}{\partial \alpha} > 0$, delegation has a tax increasing effect. Therefore, we characterize the policy-maker as fiscally liberal. If taxes were strategic substitutes, one can easily see that the elected policy maker would be fiscally more conservative than the median voter. However, in the coordination regime, one can infer from (16) that the elected policy maker is always fiscally conservative, independent of the sign of $\frac{\partial t_j}{\partial t_i}$.[8] Hence, delegation leads to decreasing capital taxes. Moreover, a regime switch from tax competition to coordination always induces the election of more conservative policy-makers. The political reactions to an introduction of tax coordination, therefore, compensate at least some of the immediate changes in the tax rates.

One main purpose of this paper is to investigate whether a change from tax competition to tax coordination leads to an increase or a decrease of tax rates. Essentially, this depends on the reaction functions $\frac{\partial t_j}{\partial t_i}$. To see this clearly, rewrite (14) as

$$\frac{\frac{\partial u_i}{\partial c_i}}{\beta\frac{\partial v_i}{\partial g_i}} + \eta\left(1 - \left(\frac{\partial t_j}{\partial t_i}\right)\right) = 1 \tag{17}$$

It should be noted that by anticipating the behavior of delegates, the national median voters ultimately determine the tax rates. Suppose the tax regime changes, but the tax rates remain constant. This view implies that the median voters select delegates that in equilibrium would choose the same tax rates as the previous delegates chosen under the competitive regime. Suppose now that the slope of the reaction function increases. Since marginal utility of public good consumption is decreasing in t_i whereas marginal utility of public good consumption and the tax elasticity of capital are increasing in t_i, tax rates must increase. Conversely, if the slope initially decreases, introducing tax cooperation lowers tax rates. Therefore, we have to investigate the differences of the slopes $\frac{\partial t_j}{\partial t_i}$ between the two regimes. For that, we use the following lemma:

Lemma 1 *If taxes are set competitively and $t_i = t_j$, then*

$$\frac{\partial t_j}{\partial t_i} = \frac{1 + \frac{2\eta}{1-\eta} - 2r_g}{1 + \frac{2(1+\eta)}{1-\eta} + \frac{2}{\eta}\frac{g_i}{c_i}r_c + \frac{2(1-\eta)}{\eta}r_g} \tag{18}$$

[8] Note that the condition $\frac{\partial t_j}{\partial t_i} < 1$ must hold in any equilibrium.

If taxes are set cooperatively and $t_i = t_j$, then

$$\frac{\partial t_j}{\partial t_i} = \frac{1 - 2(1-\eta)\, r_g}{1 + \frac{1}{\eta}\frac{g}{c} r_c + \left(\frac{(1-\eta)^2}{\eta} + \eta\right) r_g} \tag{19}$$

Proof. See appendix ■

In (18) and (19), r_g and r_c denote the relative risk aversion with respect to public and private good consumption, i.e.,

$$r_g = -\frac{c_i \frac{\partial^2 u_i}{\partial c_i^2}}{\frac{\partial u_i}{\partial c_i}}, \qquad r_g = -\frac{g_i \frac{\partial^2 v_i}{\partial g_i^2}}{\frac{\partial v_i}{\partial g_i}}$$

Note that in deriving (18) and (19), we made use of the equilibrium conditions for the delegates, (10) and (13), in order to eliminate α_i. The use of lemma 1 enables us to determine which tax regime results in lower tax rates.

Proposition 1 *A change from the competitive to the cooperative tax regime leads to lower tax rates if*

$$\begin{aligned} r &\geq (1 - 2(1-\eta)\, r_g)\left(2 + \frac{1-2\eta}{\eta} r\right) \quad (20) \\ \textit{where } r &= \frac{g_i}{c_i} r_c + r_g \end{aligned}$$

If (20) *does not hold, tax rates increase.*
A sufficient condition for a tax decrease induced by introducing tax cooperation is $r_g \geq 1$.

Proof. The first part follows from comparing (18) and (19) and the arguments made before. For the sufficient condition, note that (20) implies

$$r \geq (1 - 2(1-\eta)\, r)\left(2 + \frac{1-2\eta}{\eta} r\right) \tag{21}$$

It can then easily be shown that $r \geq 1$ fulfills this condition for any $0 \leq \eta \leq 1$. Finally, note that $r_g \geq 1$ implies $r \geq 1$. ■

An increase in risk-aversion with respect to public good consumption flattens the slope of the reaction function in both regimes because the tax externalities become more important. However, in case of tax cooperation, the decrease in the slope is relatively larger, since the reaction functions depend on the utility of both policy-makers. It should be emphasized that the condition $r_g \geq 1$ is by far not necessary for decreasing tax rates.

First, the ratio of public to private good consumption is smaller than one, but usually significantly larger than zero. Moreover, agents are normally assumed to be risk-averse with respect to private good consumption. Hence, $r \geq 1$ might hold even if r_g is (slightly) lower than 1. Second, in the initial equilibrium under tax competition, η will be strictly smaller than one, as can be seen from (10). Since it can be shown that right hand side of (21) is increasing in η, (20) might well hold even if r is smaller than one.

In the next section we will use a specific example to further illustrate the (possible) tax decreasing effect of introducing tax cooperation.

3 Example

In this section, it is assumed that preferences are log-linear and that the production function is Cobb-Douglas. For analytical convenience, the production function is symmetric with respect to both inputs.

$$u(c) = \ln c \tag{22}$$

$$v(g) = \ln g \tag{23}$$

$$f(k) = k^{\frac{1}{2}} \tag{24}$$

$$f''(k) = -\frac{1}{4}k^{-\frac{3}{2}} \tag{25}$$

This specification implies that $r_g = 1$ so that we know from proposition 1 that tax rates will be lower under tax cooperation. We normalized the type of the median voters, β, to one since proposition 1 implies that β does not affect the relative ranking of the tax regimes.

First, we explicitly consider the equilibrium choices for the delegates. Inserting (10) and (22) to (25) into (14) and some algebra yields $\alpha = 1.3984$. However, doing the same exercise for the cooperative tax regime, results is $\alpha = 0.4411$.[9] Hence, we might conclude that delegation, measured by the difference in types between median voters and delegates, is more pronounced in case of tax coordination. This result is not surprising. In this regime, the delegates take the externalities of tax rates on each other into account.

[9]The fact that the types of the delegates are independent of the capital endowments S is due to the specification of the utility functions.

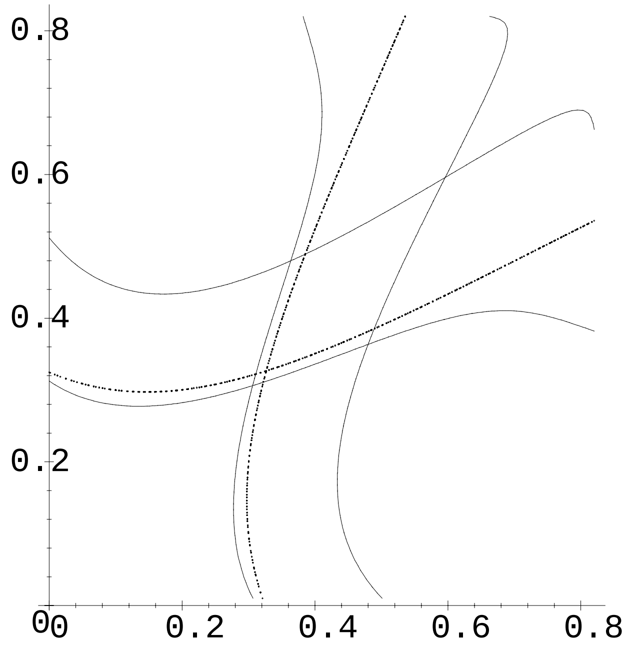
Thus, compared to tax competition, the median voters must choose delegates with a larger preference bias ($|\alpha_i - \beta|$) in order to unilaterally achieve a certain change in tax rates. Still, lower tax rates with tax coordination might seem to be a paradox. The main reason for this result is the lack of a competition alleviating mechanism under tax coordination. To see this point, let, without loss of generality, $S = 1$. The resulting tax rates are 0.3266 in case of tax competition and 0.3061 in case of tax coordination. Consider also the hypothetical tax rates that emerged in the absence of strategic delegation. Letting $\alpha = 1$ in (10) resulted in competitively set tax rates of 0.2929. On the other hand, without delegation, tax coordination yielded a tax rate of 0.5, as can be derived from (13) with $\alpha = 1$. As discussed in the introduction, competition under tax coordination works via strategic delegation of policy makers in the first stage. Since the equilibrium tax rate of 0.3061 is higher than the competitive tax rate without delegation of 0.2929, the tax decreasing competition effect appears to be weaker in the case of tax coordination. However, under tax competition, strategic delegation can be used to alleviate the tax decreasing mechanism that works in the second stage. Due to the absence of such a mechanism, an introduction of tax coordination eventually leads to a tax decrease.

We can further illustrate this example by drawing the reaction function of the policy makers. With the help of some tedious algebra, we can actually write the equilibrium conditions of capital market clearing and the non-arbitrage condition as

$$k_i = 1 - sign\left(t_i - t_j\right) \sqrt{\frac{\left(8\left(t_i - t_j\right)^4 - 1 - 4\left(t_i - t_j\right)^2 + \sqrt{\left(1 + 8\left(t_i - t_j\right)^2\right)}\right)}{8\left(t_i - t_j\right)^4}} \tag{26}$$

Assume we are in the competitive regime and want to investigate the effects of a regime switch. The initial reaction functions can be obtained by inserting (26) into the FOC's of the policy makers (10) and letting $\alpha = 1.3984$, the equilibrium value derived above. In figure 2, these functions are given by the two dotted curves. We see that tax rates are strategic complements for intermediate and high levels of the other country's tax rate. However, for very low levels of the other country's tax rate, $\frac{\partial t_i}{\partial t_j}$ has a negative slope. This is because for low levels of t_j total factor income in country i is reduced if the other country's tax rate increases. The decrease in capital income due to suppressed after-tax-returns overcompensates the wage increase due to capital inflows. By lowering taxes country i's policy maker partly offsets this reduction in private consumption.

Figure 1: Reaction functions



The immediate effect of introducing tax coordination can be inferred from the new reaction functions that we obtain by inserting (26) into (13) with $\alpha = 1.3984$.[10] They are drawn as the two outer solid lines in figure 1. As discussed above, the internalization of tax externalities quite substantially shifts the reaction function outwards. Moreover, we see that taxes are now strategic substitutes not only for low (as before) but also for high values of the other country's tax rate. In this regime, policy maker i also lowers his tax rate in order to compensate a negative income effect for policy maker j. Nevertheless, taxes are still strategic complements for intermediate tax rates. However, the electorates react on this regime change by choosing fiscally more conservative policy makers. This leads to an inward shift of the reaction functions. Using (26), (13) and choosing the new equilibrium type of delegates of $\alpha = 0.4411$ results in the two inner solid lines in figure 1. As we derived from proposition 1, this policy effect overcompensates the internalization effect in our example. Therefore, equilibrium tax rates on capital are reduced.

[10] Since taxes are now set cooperatively, these are not reaction functions in a strict sense. However, tax coordination is equivalent to a situation in which each policy-maker sets his tax rate independently, but the other policy-maker's utility enters his objective function with equal weight.

4 Conclusion

This paper investigates the political economy effects of two different regimes of international capital taxation, tax competition and tax coordination. Contrary to the popular view, tax coordination can lead to lower tax rates. Once the political reactions are taken into account, tax coordination fails to eliminate the competition for internationally mobile capital. Instead, this incentive is moved to the stage in which policy makers are selected. This analysis leads to important policy implications. We do not expect large drifts in capital tax rates if tax coordination were introduced. If agents are sufficiently risk-averse with respect to public good consumption, e.g., as in the case of a log-linear utility function, tax rates would even decline further. The current political and economic debate on capital taxation in Europe focuses on the normative issue whether capital taxes, from a social point of view, are too low or too high. The positive question, whether tax coordination increases tax rates, is usually answered affirmative without explicit investigation. However, this paper shows that this view is questionable.

The model presented is certainly not well suited to give a direct recommendation on whether tax coordination is advisable from a social point of view, even though it is based on a standard model in the tax competition literature. For that, the model had to be simultaneously extended along several lines, which may probably come at the cost of loosing tractability. The model should be dynamic to make savings endogenous and the symmetry assumption should be relaxed. It could also be worthwhile to allow for distorting wage taxes. Moreover, possible systematic differences between politically determined and socially optimally preferences for public goods have to be taken into account. But already in the present form, the paper clearly demonstrated that a decision on introducing tax coordination, e.g., in the European Union, must carefully take the induced political reactions into account.

Appendix

Proof of lemma 1

Under the competitive regime, taxes are defined by

$$u_i'\frac{\partial c_i}{\partial t_i}+\alpha_i v_i'\frac{\partial g_i}{\partial t_i}=0$$

For the reaction functions, we have by the implicit function theorem

$$\frac{\partial t_j}{\partial t_i}=-\frac{u_i'\frac{\partial^2 c_i}{\partial t_i t_j}+u_i''\frac{\partial c_i}{\partial t_i}\frac{\partial c_i}{\partial t_j}+\alpha_i v_i'\frac{\partial^2 g_i}{\partial t_i t_j}+\alpha_i v_i''\frac{\partial g_i}{\partial t_i}\frac{\partial g_i}{\partial t_j}}{u_i'\frac{\partial^2 c_i}{\partial t_i^2}+u_i''\left(\frac{\partial c_i}{\partial t_i}\right)^2+\alpha_i v_i'\frac{\partial^2 g_i}{\partial t_i^2}+\alpha_i v_i''\left(\frac{\partial g_i}{\partial t_i}\right)^2}$$

Replacing α_i with the equilibrium condition (10), dividing both numerator and denominator by u_i' and using the definition for relative risk aversion $r_g=-\frac{g_i v_i''}{v_i'}$, $\qquad r_c=-\frac{c_i u_i''}{u_i'}$ yields

$$\frac{\partial t_j}{\partial t_i}=-\frac{\frac{\partial^2 c_i}{\partial t_i t_j}-\frac{r_c}{c_i}\frac{\partial c_i}{\partial t_i}\frac{\partial c_i}{\partial t_j}-\frac{\partial^2 g_i}{\partial t_i t_j}\frac{\frac{\partial c_i}{\partial t_i}}{\frac{\partial g_i}{\partial t_i}}+\frac{r_g}{g_i}\frac{\partial c_i}{\partial t_i}\frac{\partial g_i}{\partial t_j}}{\frac{\partial^2 c_i}{\partial t_i^2}-\frac{r_c}{c_i}\left(\frac{\partial c_i}{\partial t_i}\right)^2-\frac{\partial^2 g_i}{\partial t_i^2}\frac{\frac{\partial c_i}{\partial t_i}}{\frac{\partial g_i}{\partial t_i}}+\frac{r_g}{g_i}\frac{\partial c_i}{\partial t_i}\frac{\partial g_i}{\partial t_i}}$$

We have

$$\begin{aligned}
\frac{\partial c_i}{\partial t_i} &= \frac{f''(k_i)}{f''(k_i)+f''(k_j)}(S-k_i)-S, \quad \frac{\partial c_i}{\partial t_j}=-\frac{f''(k_i)}{f''(k_i)+f''(k_j)}(S-k_i)\\
\frac{\partial^2 c_i}{\partial t_i^2} &= \frac{\partial\frac{f''(k_i)}{f''(k_i)+f''(k_j)}}{\partial t_i}(S-k_i)-\frac{f''(k_i)}{\left(f''(k_i)+f''(k_j)\right)^2}\\
\frac{\partial^2 c_i}{\partial t_i t_j} &= \frac{\partial\frac{f''(k_i)}{f''(k_i)+f''(k_j)}}{\partial t_j}(S-k_i)+\frac{f''(k_i)}{\left(f''(k_i)+f''(k_j)\right)^2}\\
\frac{\partial^2 c_i}{\partial t_j^2} &= -\frac{\partial\frac{f''(k_i)}{f''(k_i)+f''(k_j)}}{\partial t_i}(S-k_i)-\frac{f''(k_i)}{\left(f''(k_i)+f''(k_j)\right)^2}\\
\frac{\partial g_i}{\partial t_i} &= k_i+\frac{t_i}{f''(k_i)+f''(k_j)}, \quad \frac{\partial g_i}{\partial t_j}=-\frac{t_i}{f''(k_i)+f''(k_j)}\\
\frac{\partial^2 g_i}{\partial t_i^2} &= \frac{2}{f''(k_i)+f''(k_j)}+\frac{t_i\left(f'''(k_i)-f'''(k_j)\right)}{\left(f''(k_i)+f''(k_j)\right)^3}\\
\frac{\partial^2 g_i}{\partial t_i t_j} &= -\frac{1}{f''(k_i)+f''(k_j)}-\frac{t_i\left(f'''(k_i)-f'''(k_j)\right)}{\left(f''(k_i)+f''(k_j)\right)^3}\\
\frac{\partial^2 g_i}{\partial t_j^2} &= -\frac{t_i\left(f'''(k_i)-f'''(k_j)\right)}{\left(f''(k_i)+f''(k_j)\right)^3}
\end{aligned}$$

Using the fact that $t_i=t_j\Rightarrow k_i=k_j=S$ leads to the expression for the reaction function

$$\frac{\partial t_j}{\partial t_i} = -\frac{\frac{1}{4f''(S)}-\frac{S}{2Sf''(S)+t_i}+\frac{r_g}{g_i}\frac{St_i}{2f''(S)}}{-\frac{1}{4f''(S)}-\frac{r_c}{c_i}S^2+\frac{2S}{2Sf''(S)+t_i}-\frac{r_g}{g_i}S\left(S+\frac{t_i}{2f''(S)}\right)}$$

$$
\begin{aligned}
&= -\frac{\frac{1}{4f''(S)} - \frac{S}{2Sf''(S)+t_i} + \frac{r_g}{2f''(S)}}{-\frac{1}{4f''(S)} - \frac{r_c}{c_i}S^2 + \frac{2S}{2Sf''(S)+t_i} - r_g\left(\frac{S}{t_i} + \frac{1}{2f''(S)}\right)} \\
&= \frac{-\frac{1}{2} + \frac{1}{1-\eta} - r_g}{-\frac{1}{2} + \frac{g_i}{c_i}\frac{1}{\eta}r_c + \frac{2}{1-\eta} + \frac{1-\eta}{\eta}r_g} \\
&= \frac{1 + \frac{2\eta}{1-\eta} - 2r_g}{1 + \frac{2(1+\eta)}{1-\eta} + \frac{2}{\eta}\frac{g_i}{c_i}r_c + \frac{2(1-\eta)}{\eta}r_g}
\end{aligned}
$$

In a similar fashion, we can derive the reaction functions $\frac{\partial t_j}{\partial t_i}$ in the cooperative regime by implicitly differentiating (12) and employing the fact that in equilibrium, marginal utilities are the same in both countries.

$$
\begin{aligned}
\frac{\partial t_j}{\partial t_i} &= -\left[\frac{\begin{array}{c} u_i'\frac{\partial^2 c_i}{\partial t_i t_j} + u_i''\frac{\partial c_i}{\partial t_i}\frac{\partial c_i}{\partial t_j} + \alpha_i v_i'\frac{\partial^2 g_i}{\partial t_i t_j} + \alpha_i v_i''\frac{\partial g_i}{\partial t_i}\frac{\partial g_i}{\partial t_j} \\ +u_j'\frac{\partial^2 c_j}{\partial t_i t_j} + u_j''\frac{\partial c_j}{\partial t_i}\frac{\partial c_j}{\partial t_j} + \alpha_j v_j'\frac{\partial^2 g_j}{\partial t_i t_j} + \alpha_j v_i''\frac{\partial g_j}{\partial t_i}\frac{\partial g_j}{\partial t_j} \end{array}}{\begin{array}{c} u_i'\frac{\partial^2 c_i}{\partial t_i^2} + u_i''\left(\frac{\partial c_i}{\partial t_i}\right)^2 + \alpha_i v_i'\frac{\partial^2 g_i}{\partial t_i^2} + \alpha_i v_i''\left(\frac{\partial g_i}{\partial t_i}\right)^2 \\ +u_j'\frac{\partial^2 c_j}{\partial t_i^2} + u_j''\left(\frac{\partial c_j}{\partial t_i}\right)^2 + \alpha_j v_j'\frac{\partial^2 g_j}{\partial t_i^2} + \alpha_j v_j''\left(\frac{\partial g_j}{\partial t_i}\right)^2 \end{array}}\right] \\
&= -\left[\frac{\frac{\partial^2 c_i}{\partial t_i t_j} - \frac{r_c}{c_i}\frac{\partial c_i}{\partial t_i}\frac{\partial c_i}{\partial t_j} - \frac{\partial^2 g_i}{\partial t_i t_j}\frac{\frac{\partial c_i}{\partial t_i} - \frac{\partial c_i}{\partial t_j}}{\frac{\partial g_i}{\partial t_i} - \frac{\partial g_i}{\partial t_j}} + \frac{r_g}{g_i}\frac{\partial g_i}{\partial t_i}\frac{\partial g_i}{\partial t_j}\frac{\frac{\partial c_i}{\partial t_i} - \frac{\partial c_i}{\partial t_j}}{\frac{\partial g_i}{\partial t_i} - \frac{\partial g_i}{\partial t_j}}}{\left(\begin{array}{c} \frac{1}{2}\left(\frac{\partial^2 c_i}{\partial t_i^2} + \frac{\partial^2 c_j}{\partial t_i^2}\right) - \frac{r_c}{c_i}\frac{1}{2}\left(\left(\frac{\partial c_i}{\partial t_i}\right)^2 + \left(\frac{\partial c_j}{\partial t_i}\right)^2\right) \\ -\frac{1}{2}\left(\frac{\partial^2 g_i}{\partial t_i^2} + \frac{\partial^2 g_j}{\partial t_i^2}\right)\frac{\frac{\partial c_i}{\partial t_i} - \frac{\partial c_i}{\partial t_j}}{\frac{\partial g_i}{\partial t_i} - \frac{\partial g_i}{\partial t_j}} + \frac{r_g}{g_i}\frac{1}{2}\left(\left(\frac{\partial g_i}{\partial t_i}\right)^2 + \left(\frac{\partial g_j}{\partial t_i}\right)^2\right)\frac{\frac{\partial c_i}{\partial t_i} - \frac{\partial c_i}{\partial t_j}}{\frac{\partial g_i}{\partial t_i} - \frac{\partial g_i}{\partial t_j}} \end{array}\right)}\right]
\end{aligned}
$$

Using $t_i = t_j \Rightarrow k_i = k_j = S$ and some algebra then yields

$$
\begin{aligned}
\frac{\partial t_j}{\partial t_i} &= \frac{-\frac{1}{2} + 1 - (1-\eta)\,r_g}{-\frac{1}{2} + \frac{g_i}{c_i}\frac{1}{2\eta}r_c + 1 + \frac{(1-\eta)^2+\eta^2}{2\eta}r_g} \\
&= \frac{1 - 2\,(1-\eta)\,r_g}{1 + \frac{1}{\eta}\frac{g_i}{c_i}r_c + \left(\frac{(1-\eta)^2}{\eta} + \eta\right)r_g}
\end{aligned}
$$

■

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