Tax Competition and Partial Coordination

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Abstract

To determine the welfare effects of tax coordination, it is often assumed that one tax is jointly increased and all other policy instruments are held constant. This paper, in contrast, analyzes partial coordination in the sense that each country can still adjust another tax, which is not subject to coordination. In a model with capital and labor taxation, we show that under plausible assumptions the welfare effect of coordinating the capital tax only is then still non-negative. For a partial coordination of the labor tax, however, results become ambiguous and depend on the labor supply elasticity.

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1 Introduction

Starting with the seminal contributions by Wilson (1986) as well as Zodrow and Mieszkowski (1986), there exists a vast literature on tax competition pointing out that the level of provision of local public consumption goods by small countries is too low compared to that expected under the famous Samuelson rule (Samuelson, 1954).[1] The reason for the underprovision result is that a tax base (capital) which is immobile and thus a source of lump-sum tax revenue for the whole world is perceived as perfectly elastic by a small country and therefore gives rise to distortions in taxation. In changing domestic capital employment with policy instruments, each individual jurisdiction ignores the external effect capital movements have on other countries (cf. Wildasin, 1989). It is therefore beneficial for all countries to raise their tax rates jointly in order to capture resources from capital owners in a lump-sum manner. In doing so, it is generally assumed that coordination is complete in the sense that the countries involved do not adjust other tax rates or other policy variables. However, such an "all-inclusive" coordination agreement that covers all possible policy instruments that might be able to influence domestic capital employment seems to be rather unrealistic. Therefore, this paper analyzes how overall welfare is affected by partial coordination agreements that leave open the possibility for each country to adjust some non-coordinated tax instruments.

So far only a few theoretical models have explicitly analyzed the possibility of countries responding to coordination agreements by adjusting other available policy instruments in order to increase their own welfare. In a seminal paper by Copeland (1990), two governments are involved in negotiations with respect to trade policy. In a first stage, both governments jointly choose a negotiable trade barrier, while, in a second stage, a non-negotiable trade barrier is chosen non-cooperatively. As a result, negotiations aimed at reducing a trade barrier nevertheless enhance welfare as long as the second instrument of trade protection is not a perfect substitute for the first one. The case of government spending decisions that might not be affected by international coordination is considered in Fuest (1995). Since a government can

[1] See Wilson (1999) for a survey.

increase domestic investment by supplying a public infrastructure good that raises the marginal product of capital, this instrument will be used if the capital tax is jointly increased. Starting from a positive capital tax rate, each country tries to further benefit from capital taxation by enlarging its tax base. Due to the assumption that the worldwide supply of public input is constant, however, this adjustment leads to an increase in the price of the public input good so that the overall welfare effect is ambiguous and depends on the shape of the production technology. In a rather broad context with a capital tax and a labor tax as well as a public consumption good and a public input good, Keen and Marchand (1997) emphasize that the case of partial tax coordination is of practical importance in policy making, but they do not analyze this topic further. Fuest and Huber (1999a) set up a two period model with four policy instruments: a corporate tax, a withholding tax on interest income, a value-added tax, and depreciation allowances. They show that the joint introduction of a minimum tax rate, letting the countries choose the other policy parameters without any constraint, is neutral with respect to overall welfare. In their model, it is always possible to completely undo the change in capital costs caused by a minimum tax rate agreement so that the uncoordinated equilibrium is restored. Cremer and Gahvari (2000) combine the standard tax competition result with the possibility of tax evasion and auditing activities by the government. They show, in a two-country model with a tax on a private good as well as an audit rate, that harmonizing the tax rates only cannot completely eliminate the fiscal externality of tax competition, as long as each country retains national autonomy in the choice of the audit rate. Recently, Marchand et al. (2003) address capital and labor taxes in a model of partial tax coordination. However, their model considers capital as well as labor to be perfectly mobile between countries and assumes rather *ad hoc* that when taxes are only used for redistributive purposes, redistribution from capital owners to workers enhances welfare. Moreover, they do not provide a comprehensive welfare analysis by considering the overall welfare implication but rather discuss the impact of tax adjustment after coordination.

This paper explicitly discusses factor taxation of mobile capital and immobile labor in a model with public good provision and imperfect profit taxation. Partial coordination is incorporated by considering the effect of coordination of one tax instrument on the efficiency costs of the tax instrument that is free to adjust after coordination has taken place. We derive the overall welfare effect of partial coordination and show that a partial coordination of the capital tax - starting in the Nash-equilibrium - cannot be welfare worsening under plausible assumptions. For the labor tax, however, partial coordination has an ambiguous welfare effect in the sense that all countries will only benefit from such a joint increase in the labor tax if the labor supply elasticity is increasing in the net wage rate.

The paper is organized as follows. In the next section, the basic model of the paper is described. Section 3 then characterizes the Nash equilibrium. As a benchmark case, section 4 considers complete tax coordination. The welfare effects of partial tax coordination are then analyzed in section 5. The last section summarizes and concludes.

2 The model

We consider an economy that consists of many small and symmetric countries with a large number of homogenous households, where the number of households in each country is normalized to one. A representative household is endowed with a fixed amount of capital $\overline{K}$ that is perfectly mobile and can be invested in the home country or in the rest of the world to earn a constant net return r. In addition to capital income $r\overline{K}$, households obtain income by supplying labor, where we assume that labor is perfectly immobile and each household can decide on its labor supply L^S by maximizing the difference between net wage income wL^S and monetarized disutility of labor $e(L^S)$, where $e' > 0$.

Total household utility V then consists of two parts. The first one is linear and includes capital earnings $r\overline{K}$, the net benefit from labor supply in monetary units $wL^S - e(L^S)$ as well as net of tax profits $(1 - t_\pi)\pi$ from firm ownership. The second part is utility derived from public good consumption $U(G)$ with $U' > 0$ and $U'' < 0$. Hence,

$$V = r\overline{K} + wL^S - e(L^S) + (1 - t_\pi)\pi + U(G). \tag{1}$$

Each household chooses labor supply by equating the net wage rate to marginal disutility of labor, $w = e'(L^S)$, which implicitly defines labor supply $L^S(w)$ with $dL^S/dw = 1/e''(L^S)$. The formulation of household utility allows for a labor supply that is independent of the public good provision.[2] Following Keen and Marchand (1997) and Fuest and Huber (1999b), we assume $e'' > 0$ so that labor supply is increasing in the net of tax wage rate.[3]

The government provides the public good G and raises revenue R with a non-distortionary profit tax t_π levied on the rent of a third (non-specified) factor,[4] a source-based capital tax t_r on net capital income from domestic capital input, and a wage tax t_w on net labor income. We will assume that profit tax revenue does not suffice to provide the public good at the first-best level. Thus, the government budget constraint is given by

$$G = t_\pi \pi + t_r r K + t_w w L = R, \tag{2}$$

where the marginal cost of the public good is normalized to one, implying a marginal rate of transformation of one between private output and the public good.

Turning to the production side of the small economy, a homogenous output good Y is produced by using capital K and labor L as inputs. To keep the model manageable, we use a production function with a constant elasticity of substitution between labor and capital and decreasing returns to scale:

$$Y = \left[\left(K^{\frac{\sigma-1}{\sigma}} + L^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \right]^{1-\frac{1}{\varepsilon}}, \tag{3}$$

where the parameter $\varepsilon > 1$ indicates decreasing returns to scale and $\sigma \geq 0$ denotes the elasticity of substitution between capital and labor. Both factor markets as well

[2]Note that this is due to the specification of the disutility of labor supply as part of the linear consumption term. The assumption of separability in the public good consumption is made for notational convenience and could be dropped without changing the results since the labor supply decision will be unaffected.

[3]This is also supported by empirical evidence. See Blundell and MaCurdy (1999) for a survey.

[4]Since we assume firms to be immobile, a tax on profits is indeed non-distortionary. This is a standard assumption in the existing literature. For models with firm mobility see e.g. Richter and Wellisch (1996) or Eggert and Goerke (2004).

as the output market are characterized by perfect competition. The price of output is normalized to one.[5]

Taking gross factor prices $\tilde{r} = (1 + t_r)r$ and $\tilde{w} = (1 + t_w)w$ as given, firms maximize profits and thereby choose capital and labor inputs according to $Y_K = \tilde{r}$ and $Y_L = \tilde{w}$. Together with the above production function, this allows us to derive unconditional factor demands $L(\tilde{w}, \tilde{r})$ and $K(\tilde{w}, \tilde{r})$ with corresponding elasticities that solely depend on the parameters σ and ε as well as on the cost share of labor s (see Hamermesh, 1993 or e.g. Koskela and Schöb, 2002):

$$\eta_{L,\tilde{w}} = -(1-s)\sigma - s\varepsilon < 0, \tag{4}$$

$$\eta_{K,\tilde{r}} = -s\sigma - (1-s)\varepsilon < 0, \tag{5}$$

$$\eta_{L,\tilde{r}} = (1-s)(\sigma - \varepsilon), \tag{6}$$

$$\eta_{K,\tilde{w}} = s(\sigma - \varepsilon), \tag{7}$$

where s is given by

$$s = \frac{\tilde{w}^{1-\sigma}}{\tilde{w}^{1-\sigma} + \tilde{r}^{1-\sigma}}. \tag{8}$$

As is usual in the literature, we assume that capital and labor are price complements ($Y_{KL} > 0$), which is equivalent to $\sigma - \varepsilon < 0$, so that both cross-price elasticities, (6) and (7), are negative. By assuming $\sigma - \varepsilon > 0$, however, we could easily incorporate the case of factors being substitutes.

3 Nash equilibrium

3.1 Comparative static results

Since the net factor price of capital is constant at r under our small country assumption, we only need to determine how wages change as a reaction to changes in tax rates. This is done under the Nash assumption that each country takes the policy variables of all other countries as given.

[5] Note that we can also interpret equation (3) as being a linear-homogenous production function, where output faces imperfect competition on the world product market due to monopolistic competition (see Dixit and Stiglitz, 1977). In this case, ε represents the price elasticity of output demand.

By totally differentiating the labor market equilibrium

$$L^S(w) - L(\tilde{w}, \tilde{r}) = 0, \tag{9}$$

we get $w = w(t_w, t_r)$ with

$$\begin{aligned} w_{t_w} &= \frac{w}{(1+t_w)} \frac{\eta_{L,\tilde{w}}}{\eta^S - \eta_{L,\tilde{w}}} < 0, \ \tilde{w}_{t_w} = w \frac{\eta^S}{\eta^S - \eta_{L,\tilde{w}}} > 0, & (10) \\ w_{t_r} &= \frac{w}{(1+t_r)} \frac{\eta_{L,\tilde{r}}}{\eta^S - \eta_{L,\tilde{w}}} < 0, \ \tilde{w}_{t_r} = \frac{\tilde{w}}{(1+t_r)} \frac{\eta_{L,\tilde{r}}}{\eta^S - \eta_{L,\tilde{w}}} < 0, & (11) \end{aligned}$$

where η^S denotes the labor supply elasticity $\eta^S \equiv w / \left[L^S e''(L^S)\right] > 0$. Increasing the labor tax reduces the net of tax wage rate while raising the gross wage rate. In contrast, if labor and capital are complements in production, taxing domestic capital income more heavily reduces labor demand, which in turn lowers both the net and gross wage rate.

3.2 Welfare maximization

The government maximizes the utility of domestic private households given the government budget constraint (2), wage reactions $w = w(t_w, t_r)$, and a restriction on the maximum profit tax rate $\bar{t}_\pi$. The corresponding Lagrangian is given by

$$\max_{G, t_\pi, t_w, t_r} \begin{aligned} \mathcal{L} = r\overline{K} + wL - e(L) + (1-t_\pi)\pi + U(G) + \lambda\left(t_\pi \pi + t_w wL + t_r rK - G\right) \\ + \mu\left(\bar{t}_\pi - t_\pi\right), \end{aligned} \tag{12}$$

where λ and μ are Lagrangian multipliers.

The first-order conditions with respect to the public good and the profit tax rate are as follows:

$$\frac{\partial \mathcal{L}}{\partial G} = 0 \Rightarrow U'(G) = \lambda, \tag{13}$$

$$\frac{\partial \mathcal{L}}{\partial t_\pi} = 0 \Rightarrow (\lambda - 1)\pi = \mu. \tag{14}$$

According to equation (13), public good provision should be expanded until total marginal utility of public good consumption equals marginal costs of its provision. In our case, the latter is equal to the marginal costs of public funds λ since by assumption the marginal rate of transformation between Y and G is equal to one. This is referred to as the modified Samuelson rule (cf. Atkinson and Stern, 1974).

Given the complementary slackness condition

$$\mu\left(\bar{t}_\pi - t_\pi\right) = 0, \tag{15}$$

we can distinguish two cases. Firstly, if the restriction on profit taxation is not binding ($\bar{t}_\pi > t_\pi$), we have $\mu = 0$ and we can infer from (14) that $\lambda = 1$, i.e. tax revenue is raised non-distortionarily by the profit tax and public good provision is, according to (13), already first-best since $U'(G) = 1$. Secondly, if the restriction is binding, then $t_\pi = \bar{t}_\pi$ and $\mu > 0$ so that $\lambda > 1$ and we are in the more relevant scenario of a second-best world, i.e. because of (at the margin) distortionary taxation the public good provision is inefficiently low, $U'(G) > 1$. In what follows, we restrict our attention to the more relevant scenario of second-best taxation, i.e. the case with $\mu > 0$ and $\lambda > 1$.

After some manipulations and using $w - e'(L) = 0$, we obtain the following first-order conditions with respect to labor and capital tax rates:

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial t_w} = 0 \Rightarrow \quad & (\lambda - 1)\left[-\frac{\eta_{L,\tilde{w}}}{1+t_w} + (1-\bar{t}_\pi)\eta^S\right] \\ & +\lambda\left[\frac{t_w}{1+t_w}\eta^S\eta_{L,\tilde{w}} + \frac{t_r}{1+t_r}\eta^S\eta_{L,\tilde{r}}\right] = 0\end{aligned} \tag{16}$$

and

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial t_r} = 0 \Rightarrow \quad & (\lambda - 1)\left[-\frac{\eta_{K,\tilde{w}}}{1+t_w} + (1-\bar{t}_\pi)\left(\eta^S - \eta_{L,\tilde{w}} + \eta_{K,\tilde{w}}\right)\right] \\ & +\lambda\left[\frac{t_w}{1+t_w}\eta^S\eta_{K,\tilde{w}} + \frac{t_r}{1+t_r}\eta^S\eta_{K,\tilde{r}} - \frac{t_r}{1+t_r}\varepsilon\sigma\right] = 0.\end{aligned} \tag{17}$$

Each given level of overall tax revenue is raised efficiently by the available tax instruments if marginal costs of public funds are equal for all tax rates. Equality of λ in (16) and (17) requires

$$\left[\frac{t_w}{1+t_w} - \frac{t_r}{1+t_r}\right](1-\bar{t}_\pi)\eta^S = \frac{t_r}{1+t_r}\frac{\varepsilon}{1+t_w}, \tag{18}$$

or, equivalently,

$$(t_w - t_r)(1-\bar{t}_\pi)\eta^S = t_r\varepsilon. \tag{19}$$

Effective tax rates on capital and labor income in the Nash equilibrium are then given by

$$\frac{t_r}{1+t_r} = \frac{(\lambda-1)}{\lambda\varepsilon}(1-\bar{t}_\pi) \geq 0 \tag{20}$$

and

$$\frac{t_w}{1+t_w} = \frac{(\lambda-1)\left[\varepsilon+(1-\bar{t}_\pi)\eta^S\right]}{\varepsilon\left[\lambda\eta^S+(\lambda-1)\right]} \geq \frac{t_r}{1+t_r}. \tag{21}$$

If profits can be completely taxed away ($\bar{t}_\pi = 1$), capital should be tax exempted. This result is well known in the literature and is often referred to as the production efficiency theorem of Diamond and Mirrlees (1971).[6] The intuition is straightforward. As long as capital owners do not obtain rent income beyond the constant world net return r, i.e. their supply is perfectly elastic, they cannot bear any tax burden and consequently the immobile factor, for which suppliers receive a rent for intra-marginal units (as long as labor supply is not perfectly elastic as well), bears the whole tax burden. A direct distortion of the labor market is therefore preferable to an indirect labor market distortion of equal size caused by a previous distortion of the capital allocation. The case of a 100 percent profit tax also offers a suitable point of reference to grasp the intuition for the following sections.

At this point, it is worth noting that for this case the optimal wage tax solely depends on the marginal costs of public funds λ, which are determined by (13), and on the labor supply elasticity as $t_w = (\lambda-1)/(\lambda\eta^S)$. To explain this, let us first consider a perfectly elastic labor supply such that both factor owners do not lose in terms of net remuneration. Both factor taxes would then be zero since, starting from zero tax rates, a marginal increase in the labor tax reduces profit tax revenue by the same amount as labor tax revenue is increased. For a finite labor supply elasticity, all intra-marginal units of L obtain a rent which now can be captured additionally using a wage tax by reducing the net of tax wage rate w. This allows to raise additional positive revenue - though again associated with an excess burden which is traded off against the utility of public good consumption. A changing labor demand elasticity is not able to alter the way of capturing this labor supply rent, i.e.

[6] See e.g. Razin and Sadka (1991). Eggert and Haufler (1999) further discuss the production efficiency theorem in an open economy.

this trade off; rather it influences the excess burden in the same way as additional tax revenue at the margin such that the wage tax rate at the optimum does not depend on labor demand elasticity but only on η^S.

For situations in which $0 \leq \bar{t}_\pi < 1$, it is optimal to have a positive tax on mobile capital since it enables the government to indirectly tax pure profits (see Huizinga and Nielsen, 1997). The extent of additional capital taxation then depends on the size of profits available and thus on the parameter ε.[7] Note that labor taxation also increases as the maximum value of permissible profit taxation $\bar{t}_\pi$ declines.

4 Complete tax coordination

Complete coordination applies when all countries agree to marginally alter one of the tax rates and at the same time to leave the other tax rate unchanged (see e.g. Bucovetsky and Wilson, 1991, Fuest and Huber, 1999b, and Wilson, 1995).[8]

The crucial point with a coordinated increase in one tax rate is the fact that induced factor price changes are different to the ones perceived by the single countries in the uncoordinated scenario. In particular, from the viewpoint of all countries the net interest rate is no longer given and capital supply is no longer perfectly elastic, but now fixed and the net interest rate becomes endogenous. Formally, the reactions of r and w in response to coordinated steps are, on the one hand, given by the equalization of labor supply and labor demand as before [see equation (9)] and, on the other hand, by the condition that, after coordination has taken place, capital employed in each country is constant and in the symmetric case must be equal to the capital endowment, i.e.

$$\overline{K} = K(\tilde{w}, \tilde{r}). \tag{22}$$

[7] Note that for the production function chosen we have a constant profit share, $\pi = Y/\varepsilon$.

[8] We may distinguish between complete *explicit* and complete *implicit* coordination, where the former describes a coordination agreement that in fact alters *both* tax rates, while in the latter, the other tax rate is kept constant. In what follows, we use the term complete coordination, but we restrict our analysis to complete *implicit* coordination.

4.1 Coordinated increase in the capital tax

If all countries increase their capital tax while (implicitly) leaving their labor tax at its previous level, the worldwide allocation of capital does not change and the real allocation remains unaltered. Since labor taxation is by assumption not changed, the net of tax wage rate is unchanged as well. The only effect is a reduced worldwide net return on capital, as the whole tax burden of the coordinated increase in the capital tax falls on capital owners. We have:

$$\left.\frac{\partial \tilde{r}}{\partial t_r}\right|_{coord.} = \left.\frac{\partial \tilde{w}}{\partial t_r}\right|_{coord.} = \left.\frac{\partial w}{\partial t_r}\right|_{coord.} = 0 \tag{23}$$

and

$$\left.\frac{\partial r}{\partial t_r}\right|_{coord.} = -\frac{r}{1+t_r} < 0. \tag{24}$$

Given these coordinated factor price reactions, we can determine the welfare effects of a (complete) coordinated increase in the capital tax starting from the Nash equilibrium:

$$\left.\frac{\partial \mathcal{L}}{\partial t_r}\right|_{coord.}^{compl.} = \overline{K}\left.\frac{\partial r}{\partial t_r}\right|_{coord.} + \lambda \overline{K}\left.\frac{\partial \left[t_r r\right]}{\partial t_r}\right|_{coord.},$$

which simplifies to

$$\left.\frac{\partial \mathcal{L}}{\partial t_r}\right|_{coord.}^{compl.} = -(\lambda - 1)\overline{K}\left.\frac{\partial r}{\partial t_r}\right|_{coord.}. \tag{25}$$

Since a coordinated increase in the capital tax rate does not alter the real allocation on the labor and capital market and thus keeps marginal products as well as the output level constant, the only change is a reduction in capital income which, however, is fully offset by additional lump-sum tax revenue accruing to the government. The welfare effect consists of that additional revenue $\partial R/\partial t_r|_{coord.} = \overline{K}\ \partial r/\partial t_r|_{coord.}$, weighted by the net welfare gain that arises if one Euro of lump-sum tax revenue is used to increase public good provision by one (monetary) unit, which amounts to $\lambda - 1 > 0$ at the second-best optimum.[9]

[9] Of course, $\lambda - 1$ also measures the net welfare gain if one Euro of lump-sum revenue is spent on reducing the level of existing distortionary taxation. However, this is excluded in our setting by implicitly keeping the (distortionary) wage tax constant.

4.2 Coordinated increase in the labor tax

As has been pointed out by Bucovetsky and Wilson (1991), a coordination of a tax rate on an immobile factor can also enhance welfare from a theoretical point of view, since it also able to reduce the rent accruing to capital owners. However, their result crucially depends on the assumption that countries are not allowed to adjust their capital tax. As we analyze in section 5 whether this welfare effect holds true if countries adjust their capital tax rate, we also consider complete labor tax coordination in our setting as a point of reference.

With regard to the repercussions on factor prices, a coordinated increase in the wage tax for a given capital tax rate has to fulfill the same two conditions as in the case of a coordinated increase in the capital tax rate, i.e. equations (9) and (22) still hold after such a joint policy. However, the result of the previous subsection cannot be carried over to the present analysis exactly since, although in the course of a labor tax coordination the capital employed within each country is still constant, a higher tax wedge is now introduced on the labor market thereby reducing worldwide equilibrium employment. Consequently, the gross wage rate increases, the net of tax wage rate declines, and, if labor and capital are complements in production, the gross and net remunerations of capital are reduced, i.e.

$$\left.\frac{\partial \tilde{w}}{\partial t_w}\right|_{coord.} = w \cdot \frac{\eta^S \eta_{K,\tilde{r}}}{\eta^S \eta_{K,\tilde{r}} - \varepsilon\sigma} > 0, \tag{26}$$

$$\left.\frac{\partial w}{\partial t_w}\right|_{coord.} = \frac{w}{1+t_w} \cdot \frac{\varepsilon\sigma}{\eta^S \eta_{K,\tilde{r}} - \varepsilon\sigma} < 0, \tag{27}$$

$$\left.\frac{\partial \tilde{r}}{\partial t_w}\right|_{coord.} = -\frac{\tilde{r}}{1+t_w} \cdot \frac{\eta^S \eta_{K,\tilde{w}}}{\eta^S \eta_{K,\tilde{r}} - \varepsilon\sigma} < 0, \tag{28}$$

$$\left.\frac{\partial r}{\partial t_w}\right|_{coord.} = -\frac{r}{1+t_w} \cdot \frac{\eta^S \eta_{K,\tilde{w}}}{\eta^S \eta_{K,\tilde{r}} - \varepsilon\sigma} < 0. \tag{29}$$

For these factor price reactions in the case of a coordination, the effect of a (complete) joint increase in the labor tax on welfare, starting from the uncoordinated Nash equilibrium, is given by

$$\begin{aligned}\left.\frac{\partial \mathcal{L}}{\partial t_w}\right|_{coord.}^{compl.} = {} & \overline{K}\left.\frac{\partial r}{\partial t_w}\right|_{coord.} + [1 - t_\pi(1-\lambda)]\left(\pi_{\tilde{r}}\left.\frac{\partial \tilde{r}}{\partial t_w}\right|_{coord.} + \pi_{\tilde{w}}\left.\frac{\partial \tilde{w}}{\partial t_w}\right|_{coord.}\right) \\ & + (1+\lambda t_w)L\left.\frac{\partial w}{\partial t_w}\right|_{coord.} + \lambda\left(wL + t_w w\left.\frac{\partial L}{\partial t_w}\right|_{coord.} + t_r K\left.\frac{\partial r}{\partial t_w}\right|_{coord.}\right),\end{aligned}$$

where all terms, except for the first one, reduce to $-\lambda \overline{K}\ \partial r/\partial t_w|_{coord.}$ when inserting the tax rates that characterize a Nash equilibrium. The welfare effect can therefore be written as

$$\left.\frac{\partial \mathcal{L}}{\partial t_w}\right|_{coord.}^{compl.} = -(\lambda - 1)\overline{K} \left.\frac{\partial r}{\partial t_w}\right|_{coord.} . \tag{30}$$

If capital and labor are assumed to be price complements, a marginal coordination is welfare enhancing although, in this case, it implies an increase in a global distortionary tax. This is because such a policy enables all countries to reduce the net interest rate, which was constant from the perspective of a single jurisdiction, thereby shifting resources from the private to the public sector at lower welfare costs. However, the intuition is slightly different to the case above. Although a *marginal* increase in the labor tax by all countries reduces employment, and thus output, due to a higher tax wedge on the labor market, the same was true for the uncoordinated choice of the labor tax. Hence, starting from the Nash equilibrium, such a coordinated increase has a first-order effect without any welfare consequences. The only relevant effect with respect to welfare is a second-order effect, which is $\partial r/\partial t_w|_{coord.} < 0$, i.e. the possibility of reducing the marginal product of capital in all countries at constant capital employment and thus transferring net capital income from the private towards the public sector.[10] Note, however, that there is no direct transfer from capital owners to the government. In fact, the first channel is profit taxation (if possible) since a declining gross remuneration of capital *ceteris paribus* increases profits for a constant capital employment. As a second channel, notice that a reduced gross interest rate *ceteris paribus* also raises employment and thus the tax base of t_w.

The welfare effects of complete coordination, where the respective other tax rate is kept constant, crucially depend on the extent to which such a policy can extract rents from capital owners. The same mechanisms as in Bucovetsky and Wilson (1991) are at work in this section. This basic incentive will also carry over to the next section. However, it will be shown that the overall effect on the net of tax interest rate changes in the case of a partial coordination.

[10] Of course, the result would change if we drop our assumption of factors being price complements; see equations (7) and (29).

5 Partial tax coordination

In contrast to a complete (implicit) coordination agreement, partial tax coordination is less restrictive. In this case, marginal coordination indeed concerns only one of the tax rates so that the respective other tax rate can be freely adjusted by each country.

5.1 Partial coordination of the capital tax

Based on the analysis in section 4.1, only one additional effect must be determined. If the capital tax was marginally increased by all countries, starting from the uncoordinated Nash equilibrium and leaving the wage tax constant, which yields the welfare gain discussed above, we now have to examine how each individual country reacts to such an "exogenous coordination" if it is free to adjust the wage tax optimally. The choice with respect to the capital tax rate t_r is fixed both by the first-order condition in the Nash equilibrium, i.e. $\partial\mathcal{L}/\partial t_r = 0$ [see equation (17)], and its marginal coordination starting from the uncoordinated equilibrium. However, all countries are now free to adjust their wage tax t_w, which was determined in the Nash equilibrium by $\partial\mathcal{L}/\partial t_w = 0$, so as to reestablish this condition again. In doing so, each country aims at equalizing marginal revenue costs between tax instruments available to reach a second-best tax system.

However, with regard to the new equilibrium one crucial point deserves attention. Each country has an incentive to adjust its wage tax individually under the Nash assumption, thereby perceiving capital supply to be perfectly elastic with a constant net interest rate, and will thus consider factor price reactions to be as calculated in section 3.1, including the perception of influencing domestic investment by the choice of t_w. Thus, all countries play a Nash game in the wage tax in order to again attract mobile capital. However, in the new equilibrium no country will succeed, since *all countries* face the same incentives regarding this wage tax adjustment, thereby triggering a joint change in the wage tax rate at a constant capital tax that finally leaves capital employment in each country unaffected. The welfare effect of this joint change has already been calculated in the previous section. Thus, to determine the new equilibrium, we need know the extent to which the wage tax rate is jointly altered. In doing so, we consider what effect a coordinated increase in the capital tax rate, as discussed in section 4.1, has on the marginal costs of public funds of the wage tax, and which worldwide (i.e. joint) change in the labor tax rate will equate these marginal costs of public funds again to the ones of the capital tax rate. Formally, equation (16), which gives us the optimal choice with respect to the wage tax in the Nash equilibrium, can be rearranged to

$$\frac{(\lambda - 1)}{\lambda} = -\frac{\frac{t_w}{1+t_w}\eta^S \eta_{L,\tilde{w}} + \frac{t_r}{1+t_r}\eta^S \eta_{L,\tilde{r}}}{(1-\bar{t}_\pi)\eta^S - \frac{\eta_{L,\tilde{w}}}{1+t_w}} \tag{31}$$

in order to facilitate calculations. Equation (31) is then totally differentiated with respect to both tax rates, in each case taking into consideration the factor price reactions for the case that the *tax rates are changed by all countries jointly.*[11] Thus, for the labor tax reaction, we obtain

$$\left.\frac{dt_w}{dt_r}\right|_{coord.} = -\frac{(1+t_w)}{(1+t_r)} \cdot \frac{\eta^S \frac{\eta_{L,\tilde{r}}}{\eta_{L,\tilde{w}}}}{\eta^S + (t_w - t_r) \left.\frac{\partial \eta^S}{\partial t_w}\right|_{coord.}}, \tag{32}$$

where

$$\left.\frac{\partial \eta^S}{\partial t_w}\right|_{coord.} = \frac{d\eta^S}{dw} \cdot \left.\frac{\partial w}{\partial t_w}\right|_{coord.}. \tag{33}$$

Note that equation (32) cannot be signed *a priori* as the net wage rate may have a positive, a negative or no impact on labor supply elasticity.

Thus, starting from the Nash equilibrium, the total effect of a partial coordination on welfare consists of

1. the initial welfare effect of a coordinated increase in the capital tax for a constant wage tax as given by equation (25), plus

2. the welfare effect of a joint change in the wage tax for a constant capital tax as given by equation (30), weighted by the extent to which all countries will finally change their labor tax in the new Nash equilibrium according to equation (32):

$$\left.\frac{d\mathcal{L}}{dt_r}\right|^{part.}_{coord.} = \left.\frac{\partial \mathcal{L}}{\partial t_r}\right|^{compl.}_{coord.} + \left.\frac{dt_w}{dt_r}\right|_{coord.} \left.\frac{\partial \mathcal{L}}{\partial t_w}\right|^{compl.}_{coord.}. \tag{34}$$

[11] All calculations are available upon request.

Consequently, by using the results from (25), (30), and (32) and after rearranging, we get

$$\left.\frac{d\mathcal{L}}{dt_r}\right|_{coord.}^{part.} = (\lambda - 1)\frac{r\overline{K}}{(1+t_r)}\left[1 - \frac{\frac{\eta_{K,\tilde{w}}\eta_{L,\tilde{r}}}{\eta_{L,\tilde{w}}\eta_{K,\tilde{r}}}}{1 - \frac{\varepsilon\sigma}{\eta^S\eta_{K,\tilde{r}}}\frac{\lambda\eta^S+(\lambda-1)\left(1-\frac{d\eta^S}{dw}\frac{w}{\eta^S}\right)}{\lambda\eta^S+(\lambda-1)}}\right]. \tag{35}$$

In order to sign the overall welfare impact, we need to determine whether the second term in brackets exceeds or falls short of unity. Firstly, the numerator does not exceed unity since

$$\frac{\eta_{K,\tilde{w}}\eta_{L,\tilde{r}}}{\eta_{L,\tilde{w}}\eta_{K,\tilde{r}}} = \frac{s(1-s)(\sigma-\varepsilon)^2}{s(1-s)(\sigma-\varepsilon)^2+\varepsilon\sigma} \leq 1.$$

Secondly, as we are not able to sign the second term of the denominator *a priori,* we have to conclude that the overall welfare effect of a partial capital tax coordination is theoretically ambiguous.

Imposing an additional assumption on the disutility of labor, however, enables us to sufficiently sign the overall welfare impact. Since the labor supply elasticity is given by $\eta^S \equiv w/\left(Le''\right)$, and

$$1 - \frac{d\eta^S}{dw}\frac{w}{\eta^S} = \eta^S + \frac{e'''e'}{e''},$$

the assumption $e''' \geq 0$ sufficiently ensures that the denominator in (35) cannot fall short of unity and the whole term in brackets is non-negative. In this case, overall welfare cannot be reduced by a partial coordination of the capital tax. In the light of the importance for this result, the assumption $e''' \geq 0$ deserves a detailed interpretation. As the slope of the labor supply curve is given by $dL^S/dw = 1/e''$, this assumption is equivalent to assuming that the slope of the labor supply curve is non-decreasing in labor supply and non-increasing in the net wage rate, $d^2L^S/dw^2 = -e'''/\left(e''\right)^3$, respectively. Considering a labor supply curve that is non-convex in the net wage rate seems to be rather restrictive. On the one hand, however, note that this is only a sufficient condition to sign the welfare effect. On the other hand, this assumption is also in line with standard microeconomic theory, as it mirrors the standard labor-leisure choice if leisure is a normal good. In this case, the labor supply has a similar shape as the income effect becomes stronger relative to the substitution effect as the net wage rate increases.[12]

Comparing this welfare effect with the one derived for a complete coordination of the capital tax, we can infer that the (relative) welfare loss due to the inability to keep the wage tax constant in the course of coordination is given by

$$\frac{\frac{\eta_{K,\tilde{w}}\eta_{L,\tilde{r}}}{\eta_{K,\tilde{r}}\eta_{L,\tilde{w}}}}{1-\frac{\varepsilon\sigma}{\eta^S\eta_{K,\tilde{r}}}\frac{\lambda\eta^S+(\lambda-1)\left(1-\frac{d\eta^S}{dw}\frac{w}{\eta^S}\right)}{\lambda\eta^S+(\lambda-1)}}\geq 0, \tag{36}$$

provided that $e''' \geq 0$. Note that for the extreme case of $\sigma = 0$ the term in (36) is unity, indicating that a partial coordination of the capital tax rate has no overall effect on welfare.

To shed some light on the basic intuition and the mechanisms at work, we consider how optimal taxation and coordination interact with the marginal costs of public funds of the wage tax instrument. First, a coordinated increase in the capital tax will increase the marginal costs of public funds. To see this, consider that according to (16) they are given by the marginal utility loss of private households per unit of additional tax revenue from t_w, i.e.

$$\lambda^{t_w} = \frac{-Lw_{t_w} + (1-\bar{t}_\pi)L\tilde{w}_{t_w}}{-Lw_{t_w} + (1-\bar{t}_\pi)L\tilde{w}_{t_w} + Lt_w\eta^S w_{t_w} + t_r r K_{t_w}}, \tag{37}$$

since we have $w = e'(L)$ at the household's optimum and $\pi_{\tilde{w}} = -L$ by Hotelling's lemma. Note that the last two terms of the denominator in (37) indicate the excess burden caused by wage taxation, i.e. the extent to which additional tax revenue falls short of the damage incurred by private households. By inspecting (37), two things are important:

1. The marginal utility loss of the private sector due to a marginal increase in the wage tax, i.e. the numerator of (37), is not affected by capital tax coordination.[13]

[12]Note, however, that we exclude the possibility of a backward-bending labor supply, as we maintain the assumption $e'' > 0$, i.e. $\eta^S > 0$.

[13]Note that as gross factor prices are unaffected by coordination in t_r, the same is true for all factor demand elasticities [see equation (8) and the expressions for demand elasticities]. Also, recall equation (10) to see that w_{t_w} and $\tilde{w}_{t_w}$ are indeed unaltered.

2. Marginal tax revenue of the wage tax rate is affected by coordination. The last term of the denominator, which represents the reaction of capital tax revenue to a change in wage taxation, declines, i.e. although $K_{t_w} = K\eta_{K,\tilde{w}}\tilde{w}_{t_w}/\tilde{w} < 0$ remains unchanged, $t_r r$ is increased by a coordinated increase in the capital tax, since $\partial[t_r r]/\partial t_r|_{coord.} = r/(1+t_r) > 0$. Consequently, marginal tax revenue of the wage tax is reduced.

Thus, as a coordinated increase in the capital tax "exogenously" renders the wage tax more distortionary at the margin, each country now seeks to lower λ^{t_w} by changing t_w. For the second part of the intuition, note that the marginal costs of public funds of a tax rate are increasing in this tax instrument, irrespective of whether the tax is increased unilaterally or collectively.[14] Thus, to counteract the above-mentioned effect on λ^{t_w}, each country has an incentive to lower its wage tax. However, the change in the wage tax by all countries still alters the allocation on the labor market, which is not the case for a joint change in the capital tax. This implies that the wage tax adjustment in the new equilibrium has to be rather small, leading to a rather low weighting being given to the welfare effect of the joint wage tax reaction. Consequently, the negative welfare impact of the induced worldwide wage tax cut will not outweigh the welfare gain caused by a coordinated increase in capital taxation, imposing rather mild assumptions on the disutility of labor. In a nutshell, as a joint change in the wage tax affects the allocation on the labor market, it is not a perfect substitute for the capital tax in terms of competing for mobile capital and the initial Nash equilibrium cannot be restored. Only for $\sigma = 0$, i.e. for capital and labor being perfect complements, does a joint change in t_w not alter employment, and all countries will compete back to the initial Nash equilibrium by using the wage tax instrument.

[14] The former must hold as a result of a second-order condition for each country's optimization. The latter is required for stability of the Nash equilibrium. Intuitively, assume that all countries start from a tax rate that is slightly lower than in the Nash equilibrium. As all countries increase their tax rate, the Nash equilibrium can only be reached, if the marginal revenue costs increase as well. Indeed, the assumption $e''' \geq 0$ is sufficient to ensure both conditions.

5.2 Partial coordination of the labor tax

In contrast to the studies of Bucovetsky and Wilson (1991) and Fuest and Huber (1999b), where complete wage tax coordination is examined as a means to improve welfare, we now consider a coordinated increase in the wage tax when countries can freely adjust the capital tax rate. Although wage tax coordination is not on the agenda of potential international coordination agreements, it may be an important issue in countries with federal structures. In particular, the wage tax rate is often centralized at the federal level while local business taxes can be freely chosen by local jurisdictions.

In the case of partial wage tax coordination, the decision with respect to the wage tax is fixed by both the behavior in the Nash equilibrium according to $\partial\mathcal{L}/\partial t_w = 0$ and the coordination agreement. Thus, we have to determine the reaction of the capital tax using $\partial\mathcal{L}/\partial t_r = 0$ [see equation (17)]. This optimal choice with respect to the capital tax rate for each government can be rearranged to

$$\frac{(\lambda-1)}{\lambda} = -\frac{\frac{t_w}{1+t_w}\eta^S\eta_{K,\tilde{w}} + \frac{t_r}{1+t_r}\eta^S\eta_{K,\tilde{r}} - \frac{t_r}{1+t_r}\varepsilon\sigma}{\left(1-\bar{t}_\pi\right)\left(\eta^S+\sigma\right) - \frac{\eta_{K,\tilde{w}}}{1+t_w}}. \tag{38}$$

Analogously to the procedure above, by implicitly differentiating this condition and taking into account that all countries face the same incentive to adjust their capital tax, we get the following tax response in the new equilibrium:

$$\left.\frac{dt_r}{dt_w}\right|_{coord.} = -\frac{(1+t_r)}{(1+t_w)}\cdot\frac{\eta_{K,\tilde{w}}\left[\eta^S + (t_w - t_r)\left.\frac{d\eta^S}{dt_w}\right|_{coord.}\right]}{\eta^S\eta_{K,\tilde{r}} - \varepsilon\sigma}. \tag{39}$$

The overall welfare effect of such a partial coordination agreement is again determined by the sum of two effects: the welfare effect of a marginal coordinated increase in the wage tax for a given level of capital taxation, plus the welfare effect of a joint change in the capital tax rate for a given wage tax weighted by the actual change of the capital tax that emerges in the new equilibrium:

$$\left.\frac{d\mathcal{L}}{dt_w}\right|_{coord.}^{part.} = \left.\frac{\partial\mathcal{L}}{\partial t_w}\right|_{coord.}^{compl.} + \left.\frac{dt_r}{dt_w}\right|_{coord.}\left.\frac{\partial\mathcal{L}}{\partial t_r}\right|_{coord.}^{compl.}. \tag{40}$$

Inserting the corresponding equations (25), (30), and (39) enables us to write the total welfare effect of a partial wage tax coordination as

$$\left.\frac{d\mathcal{L}}{dt_w}\right|_{coord.}^{part.} = -(\lambda-1)r\overline{K}\frac{1}{(1+t_w)}\frac{\eta_{K,\tilde{w}}(t_w-t_r)\left.\frac{\partial\eta^S}{\partial t_w}\right|_{coord.}}{\eta^S\eta_{K,\tilde{r}}-\varepsilon\sigma}. \tag{41}$$

From equation (19) we know that the labor tax rate is always larger in the Nash equilibrium than the capital tax rate. If we assume capital and labor to be complements in production, we are able to sign this expression as follows:

$$sign\left\{\left.\frac{d\mathcal{L}}{dt_w}\right|_{coord.}^{part.}\right\} = -sign\left\{\left.\frac{\partial\eta^S}{\partial t_w}\right|_{coord.}\right\}, \tag{42}$$

or, recalling equation (33),

$$sign\left\{\left.\frac{d\mathcal{L}}{dt_w}\right|_{coord.}^{part.}\right\} = sign\left\{\frac{\partial\eta^S}{\partial w}\right\}. \tag{43}$$

Consequently, a coordinated increase in the labor tax with national autonomy concerning the choice of the capital tax rate is associated with a positive (negative) total welfare effect for all countries in the case of an increasing (decreasing) labor supply elasticity in the net of tax wage rate.[15] For a constant labor supply elasticity, such a coordination agreement has no welfare consequences at all.

For the simple special case in which disutility of labor is characterized by $e'''=0$, the above condition reduces even further since we then have

$$\frac{d\eta^S}{dw} = \left(1-\frac{e'}{e''L}\right)\frac{1}{e''L} = (1-\eta^S)\frac{\eta^S}{w}. \tag{44}$$

Thus, whether a partial increase in the wage tax by all countries is beneficial or not can be judged by means of the absolute value of the labor supply elasticity:[16]

$$\left.\frac{d\mathcal{L}}{dt_w}\right|_{coord.}^{part.}\left\{\begin{array}{c}>\\=\\<\end{array}\right\}0 \text{ as } \eta^S\left\{\begin{array}{c}<\\=\\>\end{array}\right\}1. \tag{45}$$

[15] Note that the direction of the welfare effect again reverses if capital and labor are substitues so that $\eta_{K,\tilde{w}}$ is positive.

[16] Considering the special case $e'''=0$ does not change the theoretical ambiguity of our result. However, it allows us to assess the welfare impact by means of the absolute value of the labor supply elasticity, for which there exits a wide empirical literature. The labor supply elasticity suggested by that literature is in general smaller than one (see e.g. the survey by Blundell and MaCurdy, 1999).

In order to gain an intuition for the result, it is instructive for the time being to restrict our attention to a constant labor supply elasticity. Recalling (17), the marginal revenue costs of the capital tax are given by

$$\lambda^{t_r} = \frac{-Lw_{t_r} + (1-\bar{t}_\pi)L\tilde{w}_{t_r} + (1-\bar{t}_\pi)Kr}{-Lw_{t_r} + (1-\bar{t}_\pi)L\tilde{w}_{t_r} + (1-\bar{t}_\pi)Kr + t_w L\eta^S w_{t_r} + t_r r K_{t_r}}, \tag{46}$$

where the last two terms of the denominator represent the excess burden of capital taxation. Similarly to the preceding section, we need to explore how a marginal coordination in the wage tax affects this measure and to what extent t_r is adjusted jointly in order to again equalize efficiency costs of taxation, $\lambda^{t_r} = \lambda^{t_w}$, as each country aims at equalizing the marginal revenue costs of each tax instrument. First, it is not straightforward to determine the impact of wage tax coordination on (46), since both the marginal utility loss and the marginal tax revenue of a capital tax increase are affected. However, by considering the special case of $\bar{t}_\pi = 1$ we know that at the optimum the welfare costs of capital taxation reduce to $\lambda^{t_r} = 1/(1-t_w\eta^S)$ since the capital tax is not used in the Nash equilibrium. Thus, λ^{t_r} unambiguously rises in the course of a coordinated increase in t_w. Second, marginal costs of public funds of the capital tax increase in t_r itself, implying that each government *ceteris paribus* faces an incentive to lower t_r as its welfare costs increase "exogenously". A reduction in the capital tax rate carried out by *all countries* will also reduce λ^{t_r}. Analogously to the previous section, this must hold as a stability condition of the Nash equilibrium (see footnote 14). By differentiating (46), this can be shown to be fulfilled without resorting to restricting assumptions. It is not straightforward to see this directly by inspecting (46) since w_{t_r} and $\tilde{w}_{t_r}$ are increasing in absolute terms as the capital tax is jointly reduced [see equation (11)] and ρ is increased as well. Consequently, the marginal utility loss as well as marginal tax revenues are changed. However, for the case of $\bar{t}_\pi = 1$ again, it is easy to see that (46) reduces to $\lambda^{t_r} = 1/(1-t_w\eta^S)$ and is unchanged as a joint change in the capital tax does not alter the net of tax wage rate and thus the labor supply elasticity. However, as (negative) capital taxation is introduced by the joint capital tax adjustment, the impact on capital tax revenue has to be taken into account, i.e. the effect covered by the last term of the denominator in (46) additionally increases marginal tax revenue. Thus,

λ^{t_r} is reduced as all countries lower their capital tax. As it turns out, the coordinated increase in the wage tax has a rather large impact on λ^{t_r} compared to the subsequent joint capital tax adjustment so that the decline in t_r, which is necessary to equate $\lambda^{t_r} = \lambda^{t_w}$, is strong enough to exactly neutralize the initial welfare effect of wage tax coordination - given that the labor supply elasticity remains constant. The intuitive reason for this result is straightforward. First, recall that the Nash equilibrium is characterized by a certain level of distortion that each government is willing to accept. This translates to a wage tax that only depends on the distortion, given by λ, and the absolute value of η^S, which measures the degree of the existing wage tax distortion. Thus, if a joint increase in the wage tax does not change the labor supply elasticity, all countries can restore the initial Nash equilibrium by engaging in tax competition by using t_r after wage tax coordination. This is due to the fact that a joint change in the capital tax does not affect the real allocation and has no impact on η^S either. Hence, for constant labor supply elasticity, the overall effect on the interest rate is zero, implying that welfare is unchanged.

Once we know that the total effect on welfare is zero for the case of a constant labor supply elasticity, the point for a changing η^S is easily made. If η^S is increasing as t_w is jointly raised, i.e. η^S is declining in the net wage rate w, capital taxation becomes more costly in terms of welfare, and the coordinated increase in the wage tax increases the marginal costs of public funds of t_r more heavily.[17] This in turn calls for a greater reduction in the capital tax by all countries, which now raises the net interest rate by more than the initial decline due to wage tax coordination. Thus, overall welfare is reduced in the new equilibrium since coordination of t_w increases the preexisting distortion of the tax on the labor market. If, on the contrary, the labor supply elasticity decreases as wage taxation is jointly increased, capital taxation will now become less distortionary and t_r has to be reduced by a smaller amount to again equalize marginal costs of public funds so that this time the second round of coordination is not able to overcompensate the initial one. In this case, the coordinated increase in wage taxation mitigates the distortion of the tax system.

[17] Recall that the burden of the capital tax is fully shifted to the labor market.

6 Concluding remarks

The present paper extends the existing tax competition literature by focusing on partial tax coordination which only covers one tax rate or a subset of tax instruments while other policy instruments can still be chosen independently by the countries involved. We consider the case of two distortionary tax instruments, a capital and a labor tax rate, one of which is subject to coordination and the other is free to be adjusted by all countries individually. As it is shown, the adjustment of the free tax instrument, which is carried out by all countries in the same way, triggers a joint adjustment which will always counteract the initial coordination step with respect to its welfare gain. The welfare effect of a coordinated increase in the capital tax becomes smaller but remains positive under plausible assumptions. In contrast, with respect to the immobile factor labor, the welfare effect of a coordination of wage taxation now becomes ambiguous. This depends on whether the labor supply elasticity is increasing or decreasing. The crucial point in judging the welfare impact is, in both cases, whether coordination allows the governments to lower the net interest rate.

Qualitatively, our outcomes are not affected by the degree of maximum profit taxation. As a limitation to the analysis, however, one should keep in mind that some assumptions, in particular with regard to the disutility of supplying labor are rather restrictive from a theoretical point of view. Furthermore, one should be aware of the fact that the results may change if non-homogeneous production functions are considered. Also note that it is not possible to reach the first-best level of the public good by cooperatively choosing the global optimum with respect to the capital tax only. Countries will still engage in tax competition by using the tax on the immobile factor.

As a main policy implication from the present analysis, we can first conclude that coordination with respect to one policy instrument is welfare enhancing if other policy instruments are not perfect substitutes in attracting mobile capital to the one that is subject to coordination. This is the case when the capital tax, which is non-distortionary from a worldwide perspective, is jointly increased and a wage tax, which is distortionary even in a global sense, is available for adjustment. As a second result, we find that even with the existence of a perfect substitute marginal coordination improves welfare if - starting from the Nash equilibrium - the distortion of the tax system is reduced. This is true for a partial coordination of the wage tax, which has no welfare consequences only if the labor supply elasticity remains constant as the capital tax is used to exactly restore the Nash equilibrium.

Interesting fields of future research include the extension of the model to allow for firm mobility which renders the profit tax distortionary as well. Furthermore, the question arises whether the results derived in the present paper change if labor markets are not competitive but organized by collective wage bargaining, giving rise to involuntary unemployment. The analysis may also be enriched by distinguishing between low-skilled and high-skilled labor supply, where both differ with respect to their complementarity to capital.

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