Can Partial Fiscal Coordination Be Welfare Worsening? A model of tax competition *

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Abstract

Most work on tax competition argues that mobile factors tend to be undertaxed except if there is coordination of tax policies. Full coordination is not however always feasible, and as a consequence some measures of partial coordination have been proposed such as minimal witholding taxes on interest income. We show that partial coordination can be in some instances welfare worsening and that then no coordination is to be preferred.

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1 Introduction

The last few decades have seen growing integration of economic activities of different countries that has facilitated mobility of production factors such as capital and labor. While economic integration is beneficial in certain aspects, there has been an increasing concern that it may lead to fiscal competition among governments over mobile tax bases, constraining their ability to raise revenue for allocative and redistributive purposes. Fiscal competition results in the tax burden being shifted away from mobile tax bases into immobile ones and leads to the so-called race to the bottom. Such an unwanted outcome calls for fiscal coordination among governments.[1] In some cases coordination is enough to restore efficiency.

However for political reasons it is not always possible to agree on full tax coordination and one could be forced to resort to partial coordination. Suppose for example that both capital and unskilled labor are mobile and that a tax is imposed on both of these factors as well as on some immobile factors. Suppose further that in autarky social optimality implies taxing capital income and subsidizing income of unskilled labor. In a setting with a large number of identical countries we have no tax at all and thus no redistribution. Ideally, one would like to impose the first-best tax/subsidy structure to all countries. But if this is not possible and if the only feasible policy is to adopt a minimum tax on capital income, should we implement it? We show in this paper that such a partial coordination policy can only be socially desirable if the technology is such that the competition for the mobile factor left alone does not have so perverse effects that national social welfare decreases.

Paradoxically there has been little work on this issue of partial coordination. Fuest (1995) analyzes a model where national governments react to coordinated capital tax increases by providing more public inputs in order to attract mobile capital and thus reduce the effectiveness of coordination. Cremer and Gahvari (1996) analyze a model with tax evasion and endogenous tax auditing. They show that governments react to tax coordination by cutting effective tax rates via reduced auditing. Finally Fuest and Huber (1999) argue that partial coordination is unlikely to be effective if the interaction between different parts of the tax system is not taken into account. The reason is that coordination agreements covering only one tax will induce governments to adjust their tax policy using the other tax instruments; the inefficiencies associated with tax competition will then persist. Our paper

[1] For surveys see Wilson (1999), Cremer *et al.* (1996), Wellich (2000) or Haufler (2001).

is related to these works, but differ in that we focus on income redistribution and derive a condition for partial fiscal coordination to be welfare worsening/enhancing in an explicit and simple form.

The plan of the paper is as follows. In Section 2 the basic model is presented and the closed-economy situation leading to full redistribution of income between workers and rentiers/capitalists is discussed. The next section analyzes the consequences of integrating small countries whose governments feel unable to influence the world prices of the mobile factors through their fiscal policies. In the absence of policy coordination all taxes are set equal to zero, which means that there is no redistribution at all. In Section 4 containing the main result of the paper, the welfare effect of some partial coordination of fiscal coordination is studied. The last section presents some concluding remarks.

2 The basic model

We consider an economic union consisting of J identical countries. Within each country j, a single output Y_j is produced using three factors: land, capital and labor. Land is naturally immobile while both capital and labor are perfectly mobile. The technology is represented by a concave CRS production function:

$$Y_j = G\left(K_j, L_j, T_j\right)$$

where K_j is capital, L_j labor and T_j land, all three used in country j. Since T_j is exogenously given and identical across countries, one can also write this production function as:

$$Y_j = F\left(K_j, L_j\right) \tag{1}$$

where the rent from land use, π_j, is:

$$\pi_j = Y_j - K_j\ F_K^j - L_j\ F_L^j\,. \tag{2}$$

We assume that there are two types of individuals: the rentiers/capital owners the number of which is normalized to 1 and the L_j workers whose labor supply is also normalized to 1.

Each national government levies taxes on the three factors used within the borders of its country (source-based taxes). The only purpose of taxation here is redistributive. Therefore the budget constraint in country j is:

$$\tau_j^K\ K_j + \tau_j^L\ L_j + \tau_j^T = 0 \tag{3}$$

where the τ's denote the per-unit taxes and where the land in each country (T_j) is normalised to 1.

In a closed economy (autarky), each national government is assumed to maximize a utilitarian welfare function subject to the budget constraint just introduced:

$$SW_j = u(R_j) + L_j \; u(\Omega_j)$$

where R_j denotes the rentier/capitalist's net income and Ω_j a worker's net wage. With competitive factor markets, these are given by:

$$\begin{aligned} R_j &= \pi_j + \left(F_K^j - \tau_j^K\right) K_j - \tau_j^T = Y_j - \left(F_L^j - \tau_j^L\right) L_j, \\ \Omega_j &= F_L^j - \tau_j^L \end{aligned}$$

(we use (3) to obtain the second expression of R_j). It is quite obvious that in the closed economy setting, the only relevant tax is τ_j^L. One of the two other taxes is redundant (and can so be chosen arbitrarily)

The first-order condition for an interior maximum satisfies:

$$u'(R_j) = u'(\Omega_j)$$

and hence:

$$-\tau_j^L = \frac{Y_j}{1 + L_j} - F_L^j. \tag{4}$$

In this very simple setting, output is fully determined by the fixed inputs and is divided in $1 + L^j$ equal shares. We now consider what happens when both K and L are allowed to move.

3 Factor mobility and the race to the bottom

Perfect mobility of factors implies that their net returns are equated across countries. Namely

$$F_K^j - \tau_j^K = \varrho, \quad j = 1, ..., J$$

and

$$F_L^j - \tau_j^L = \omega, \quad j = 1, ..., J.$$

where ϱ and ω denote the net interest rate and net wage respectively in the world markets. This implies the following factor demands:

$$K_j = K_j \left(\varrho + \tau_j^K, \omega + \tau_j^L\right)$$

and

$$L_j = L_j \left(\varrho + \tau_j^K, \omega + \tau_j^L\right).$$

We will distinguish in each country the initial endowments of factors, denoted by $\bar{K}$ and $\bar{L}$, that are the same across countries and the actual levels of factors used, denoted by K_j and L_j. At the equilibrium of the world factor markets, we must have the following equalities:

$$\sum_j K_j \left(\varrho + \tau_j^K, \omega + \tau_j^L\right) = J\bar{K} \tag{5.1}$$

and

$$\sum_j L_j \left(\varrho + \tau_j^K, \omega + \tau_j^L\right) = J\bar{L}. \tag{5.2}$$

Since countries are identical, one can easily show[2] that at the symmetric equilibrium $\dfrac{d\omega}{d\tau_j^L} = -\dfrac{1}{J}$, $\dfrac{d\varrho}{d\tau_j^K} = -\dfrac{1}{J}$ and $\dfrac{d\omega}{d\tau_j^K} = \dfrac{d\varrho}{d\tau_j^L} = 0$, which implies that with J large enough, ω and ϱ are taken as given by each country. This is the assumption adopted in this paper: each country is small relative to the whole world.

When there is no government intervention, the market solution is the same in autarky and in an open economy:

$$\Omega_j = \omega = F_L\left(\bar{K}, \bar{L}\right) \tag{6}$$

and

$$R_j = F\left(\bar{K}, \bar{L}\right) - \bar{L}\,\omega. \tag{7}$$

[2] To show this, let us first totally differentiate the optimality conditions of the productive sector, i.e. $F_K^j(K_j, L_j) = r_j(\equiv \varrho + \tau_j^K)$ and $F_L^j(K_j, L_j) = w_j(\equiv \omega + \tau_j^L)$. It yields: $K_r^j \equiv \partial K_j/\partial r_j = S_j^{-1} F_{LL}^j(K_j; L_j), L_w^j = S_j^{-1} F_{KK}^j(\cdot)$ and $K_w^j = L_r^j = -S_j^{-1} F_{KL}^j(\cdot)$, where $S_j = F_{KK}^j(\cdot) F_{LL}^j(\cdot) - (F_{KL}^j(\cdot))^2$. In order to determine $d\varrho/d\tau_j^K$ and $d\omega/d\tau_j^K$, we then differentiate (4.1) and (4.2) with respect to ϱ, ω and τ_j^K, which gives $\sum_i K_r^i d\varrho + \sum_i K_w^i d\omega = -K_r^j d\tau_j^K$ and $\sum_i L_r^i d\varrho + \sum_i L_w^i d\omega = -L_r^j d\tau_j^K$. Solving this system of two equations yields $d\varrho/d\tau_j^K = -1/J$ and $d\omega/d\tau_j^K = 0$ at the symmetric equilibrium where $K_j = \overline{K}$ and $L_j = \overline{L}$, $j = 1, \cdots, J$. The other derivatives, $\partial\varrho/\partial\tau_j^L = 0$ and $\partial\omega/\partial\tau_j^L = -1/J$, are obtained in the same way.

We assume that $R_j > \omega$ in this *laissez-faire* situation.

We now turn to the implication of factor mobility on the redistributive tax policy. Each national government maximizes:

$$SW_j = u(R_j) + \bar{L}\ u(\omega).$$

We thus assume that each national government is concerned by the welfare of its natives[3] and not by that of its actual labor force. It maximizes SW_j with respect to both taxes τ_j^K and τ_j^L for given values ϱ and ω (the tax on land τ_j^T is actually a lump-sum tax. It can be set at any level, e.g. 100%, without loss of generality). Therefore, from each country's perspective maximizing SW_j amounts to maximizing R_j:

$$R_j = F_j - \varrho K_j - \omega\ L_j + \varrho\ \bar{K} = F_T^j + \tau_j^K K_j + \tau_j^L\ L_j + \varrho\ \bar{K}. \qquad (8)$$

Differentiating the first expression of R_j yields the following first-order conditions:

$$\frac{\partial R_j}{\partial \tau_j^K} = \tau_j^K \frac{\partial K_j}{\partial \tau_j^K} + \tau_j^L \frac{\partial L_j}{\partial \tau_j^K} = 0 \qquad (9.1)$$

$$\frac{\partial R_j}{\partial \tau_j^L} = \tau_j^K \frac{\partial K_j}{\partial \tau_j^L} + \tau_j^L \frac{\partial L_j}{\partial \tau_j^L} = 0. \qquad (9.2)$$

Since ϱ and ω are taken as given the effect of a change in τ_j^K on either K_j or L_j is the same as the effect of a change in $r_j \equiv \varrho + \tau_j^K$ and the same holds for τ_j^L with $w_j \equiv \omega + \tau_j^L$. We can thus rewrite:

$$\frac{\partial R_j}{\partial \tau_j^K} = \tau_j^K\ K_r^j + \tau_j^L\ L_r^j = 0 \qquad (10.1)$$

$$\frac{\partial R_j}{\partial \tau_j^L} = \tau_j^K\ K_w^j + \tau_j^L\ L_w^j = 0 \qquad (10.2)$$

where at the symmetric equilibrium,

$$K_r^j \equiv \frac{\partial K_j}{\partial r_j} = \frac{F_{LL}\left(\bar{K},\bar{L}\right)}{\overline{S}}; \qquad L_w^j \equiv \frac{\partial L_j}{\partial w_j} = \frac{F_{KK}\left(\bar{K},\bar{L}\right)}{\overline{S}};$$
$$K_w^j = \frac{\partial K_j}{\partial w_j} \equiv L_r^j = \frac{\partial L_j}{\partial r_j} = \frac{-F_{KL}\left(\bar{K},\bar{L}\right)}{\overline{S}}$$

[3]This assumption is made for the sake of simplicity.

where $\overline{S} = F_{KK}(\overline{K},\overline{L})F_{LL}(\overline{K},\overline{L}) - F^2_{KL}(\overline{K},\overline{L}) > 0$. Note for further reference that at the symmetric equilibrium the derivatives of the demand functions for K_j and L_j in (9.1) and (9.2) are identical across countries and only depend upon $\overline{K}$ and $\overline{L}$.

It is clear from (10) that $\tau^K_j = \tau^L_j = 0$. In the small open economy setting adopted here where the world prices of mobile factors are taken as given by each country, redistributive taxes are equal to zero. This is the canonical illustration of the so-called race to the bottom.

This solution is to be contrasted with that obtained in autarky and given in (4). It is also to be compared with that obtained in a cooperative framework wherein a supranational government would maximize the sum of all national social welfares. In our current setting of identical countries, the cooperative solution would be the same as (4), that is it would imply equal disposable income for the two types of individuals within and across countries.

Such a global optimum could be decentralized by letting the market forces operate but with a uniform subsidy $\left(-\tau^L\right)$ on earnings and a tax on capital income $\left(\tau^K\right)$ that would be set so as to equate the disposable incomes.

For a number of reasons pertaining mainly to political economy, it is difficult to find an agreement on such taxes. At best, one can expect that there will be an agreement around what is the most shocking consequence of tax competition, the fact that some "symbolic" sources of income, typically capital, fully escape taxation. What we now show is that reaching an agreement on a certain level of taxation of capital can be, in some instance, welfare worsening.

4 Partial tax coordination

Starting from the *laissez-faire* situation we thus now turn to the case where only some partial coordination is possible. We consider the case where in a coordinated move τ^K_j is increased to what we call a minimum rate while the other tax τ^L_j is free to vary the way the countries decide. Let τ^K be this minimum rate that all countries are forced to apply. This means that we keep condition (10.2) related to the choice of τ^L_j:

$$\tau^K\ K^j_w + \tau^L_j\ L^j_w = 0 \tag{11}$$

satisfied while the other one related to the choice of τ^K_j i.e. $\tau^K_j\ K^j_r + \tau^L_j\ L^j_r = 0$ does not hold anymore. To see the effect on τ^L_j of a small coordinated increase in τ^K, we differentiate (11) with respect to the tax rates:

$$K_w^j d\ \tau^K + L_w^j\ d\ \tau_j^L = 0,$$

which yields:

$$\frac{d\ \tau_j^L}{d\ \tau^K} = -\frac{K_w^j}{L_w^j} = \frac{F_{KL}\left(\bar{K},\bar{L}\right)}{F_{KK}\left(\bar{K},\bar{L}\right)} \tag{12}$$

since the new Nash equilibrium remains symmetric with the initial endowments of capital and labor equally shared across countries. Individual countries react to the positive capital tax rate in the same way which implies that no country succeeds in attracting more capital or labor although each aims to do so in choosing its own tax rate on labor.

Starting from disposable income $\widehat{\Omega}_j = \omega$ for the workers and $\widehat{R}_j = F\left(\bar{K},\bar{L}\right) - \bar{L}\omega$ for the rentier/capital owner in each country at the laissez-faire, we now look for the impact of an increase in τ^K on these incomes at the symmetric equilibrium: $\Omega_j = \widehat{\Omega}_j - \tau_L^j$ and $R_j = \widehat{R}_j - \tau_j^T - \tau^K\ \bar{K} = \widehat{R}_j + \tau_j^L \bar{L}$ (from (6) and (7)):

$$\frac{d\ \Omega_j}{d\ \tau^K} = -\frac{d\ \tau_j^L}{d\ \tau^K} = -\frac{F_{KL}\left(\bar{K},\bar{L}\right)}{F_{KK}\left(\bar{K},\bar{L}\right)}$$

and

$$\frac{d\ R_j}{d\ \tau^K} = \bar{L}\frac{d\ \tau_j^L}{d\ \tau^K} = \bar{L}\frac{F_{KL}\left(\bar{K},\bar{L}\right)}{F_{KK}\left(\bar{K},\bar{L}\right)}.$$

Introducing these relations in the expression for social welfare improvement, we have in each country:

$$\begin{aligned} \frac{d\ SW_j}{d\ \tau^K} &= \bar{L}\ u'\left(\Omega_j\right)\frac{d\ \Omega_j}{d\ \tau^K} + u'\left(R_j\right)\frac{d\ R_j}{d\ \tau^K} \\ &= \bar{L}\ \left[u'\left(R_j\right) - u'\left(\Omega_j\right)\right]\frac{F_{KL}(\bar{K},\bar{L})}{F_{KK}(\bar{K},\bar{L})}. \end{aligned}$$

By assumption we have in the *laissez-faire* with no tax $\widehat{\Omega}_j < \widehat{R}_j$ and thus $u'\left(\widehat{R}_j\right) < u'\left(\widehat{\Omega}_j\right)$. When moving away from that situation by increasing marginally τ^K in a coordinated way ($d\tau^K > 0$) we conclude that

$$d\ SW_j \lesseqgtr 0, \quad d\ \Omega_j \lesseqgtr 0 \text{ and } \ d\ R_j \gtreqless 0 \qquad \text{if } F_{KL}(\overline{K},\overline{L}) \lesseqgtr 0.$$

In other words, if $F_{KL}(\overline{K},\overline{L}) < 0$, namely if the two mobile factors are substitutes, then implementing a minimum tax on capital income is welfare worsening.

The intuition for this apparently paradoxical result is the following. From (12) we know that when $F_{LK}(\overline{K},\overline{L}) < 0$, $\frac{d\ \tau_j^L}{d\ \tau^K} > 0$. Basically, each country reacts to the now positive source-based tax on capital by levying a positive tax on the labor used within its boundaries since its capital tax base so increases. So doing each country takes ϱ and ω as given and thus its only purpose is to maximize the income of its rentier/capital owner. However ϱ and ω are actually affected because all countries behave in the same way, which explains why SW_j decreases. Naturally with a different technology such that $F_{LK}(\overline{K},\overline{L}) > 0$, increasing τ^K would be welfare enhancing.

5 Conclusion

In this paper we have considered a very simple economy consisting of identical small open economies with two mobile factors (capital and labor) to illustrate the idea that partial coordination can be socially undesirable. In our setting we show that when factors are mobile the global optimum can be achieved by imposing a tax on capital and a subsidy on labor (with the tax on rentiers/capital owners resulting from the budget constraint). If however only one of these two taxes can be subjected to a coordinated policy, adopting a minimum tax for capital income can be welfare worsening when capital and labour are substitutes.

The framework adopted in this paper is admittedly restrictive: small open identical countries;two types of individuals: workers and rentiers/capital owners. A more general framework could be adopted allowing for strategic behavior by countries or for more realistic social groups (skilled and unskilled workers, each holding a share of the capital stock and of the national firms). The same conclusion can be shown to hold.[4]

[4]See Marchand *et al.* (2002). In this paper we consider the case of strategic interaction with a small number of countries J; we also look at the non symmetrical case.

References

[1] Cremer, H., V. Fourgeaud, M. Leite Monteiro, M. Marchand and P. Pestieau, (1996),Mobility and redistribution: a survey, *Public Finance*, 51, 325-352.

[2] Cremer, H. and F. Gahvari, (1996), Tax evasion, fiscal competition and economic integration, Working paper, Universities of Toulouse and Illinois.

[3] Fuest, C., (1995), Interjurisdictional competition and public expenditure: is tax coordination counterproductive?, *Finanzarchiv*, 52, 478-496.

[4] Fuest, C. and B. Huber, (1999), Can tax coordination work?, *Finanzarchiv*, 56, 443-459.

[5] Haufler, A., (2001), *Taxation in a Global Economy*, Cambridge, Cambridge University Press.

[6] Marchand, M., P. Pestieau and M. Sato, (2002), Can piecewise fiscal coordination be welfare improving? A model of income redistribution, unpublished.

[7] Wellich, D., (2000), *The Theory of Public Finance in a Federal State*, New York, Cambridge University Press.

[8] Wilson, J.D., (1999), Theories of tax competition, *National Tax Journal*, 52, 269-304.