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## Corporate income tax competition, double taxation treaties, and foreign direct investment

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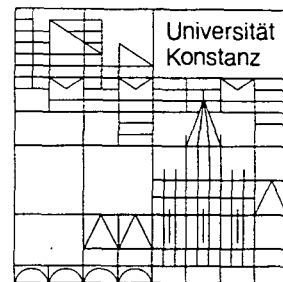
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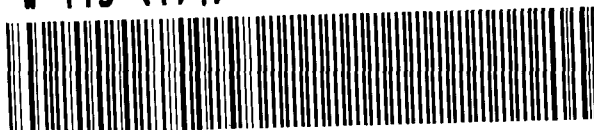
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Eckhard Janeba

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Double Taxation Treaties,  
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**CORPORATE INCOME TAX COMPETITION,  
DOUBLE TAXATION TREATIES, AND  
FOREIGN DIRECT INVESTMENT**

**Eckhard Janeba\***

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## Abstract

In the presence of international capital mobility foreign direct investment is influenced by corporate income taxation and the rules how taxes paid in the host country are treated at home. In this paper the exemption, credit and deduction method are considered as tax rules. First, it is shown that under the exemption method there exist tax rate combinations that lead to a reversal of capital flows compared to a free-trade situation. Second, the decision on the tax rule and the corporate tax rate is endogenized as outcome in a non-cooperative game. All tax rules lead to the same inefficient outcome. Therefore, for each tax rule we analyze the conditions for Pareto-improving tax cooperation. It is shown that only the credit method requires neither compensatory payments nor fully harmonized tax rates.

# 1 Introduction

More than twenty-five years ago Hamada (1966) wrote the classical paper on international tax competition and applied the concept of Cournot-Nash equilibrium to the problem how two countries determine their domestic welfare maximizing tax rates on foreign investment returns. During the eighties the topic of strategic tax policy came on the political and research agenda again. The worldwide liberalization of capital markets and in particular the European Common Market Project also affect national fiscal policies. The government's opportunity to pursue an autonomous tax policy is restricted by the mobility of factors and goods in an open economy.

The recent literature focused on the taxation of capital income when the factor capital is mobile. The question was raised whether capital income taxes can be sustained at all. To put this in the words of Roger Gordon (1990) "Can Capital Income Taxes Survive in Open Economies?". The question is reasonable since foreign earnings cannot easily be monitored and therefore not effectively taxed. The taxation of domestically generated income is problematic because the same net return as abroad must be offered. This increases the domestic gross rate of return above the world level which causes inefficiencies and might not be a good tool to raise revenue. It is the case for most portfolio investment, in particular when individuals invest their savings abroad.<sup>1</sup>

However, it has been recognized that the taxation of returns on foreign direct investment is different since a corporate firm undertakes the investment. The firm is well monitored and is usually interested in documenting the foreign direct investment. On the other hand, taxation of foreign direct investment income is more difficult due to the different provisions of double taxation treaties. A good description of the complex provisions is given in Alworth (1988) and Leechor and Mintz (1990). Since governments are interested in promoting domestic production and in increasing national welfare, the strategic use of corporate taxes in open economies was analyzed in Bond and Samuelson (1989), Gordon (1990), and Mintz and Tulkens (1990).

This paper also addresses the role of taxation in an international framework. However, in contrast to most of the literature we base our assumptions on how international capital income flows are taxed on existing tax systems. First, we assume the government to have only one corporate income tax rate. No withholding tax is levied at source. Hence, foreign owned capital cannot be discriminated. This

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<sup>1</sup>A good example was the attempt of the German government to introduce a 10 % withholding tax on interest income in 1989. Since savers could export their capital to Luxemburg, they effectively escaped German taxation.

is a good approximation of the existing situation in most western countries. In particular it corresponds to the situation in the European Community (Council of the European Communities (1990)). Second, the capital exporting country may allow for either a deduction of taxes paid in the host country, or a credit up to that amount which would have occurred under pure domestic taxation, or completely exempt from taxation. It is precisely the latter method which has not sufficiently been analyzed and which for given tax rates can lead to a reversal of capital flows compared to a free-trade situation. These two features imply that taxes paid in the host country are credited or deducted at the same corporate tax rate that also applies to purely domestic investment (Alworth (1988)).

In this paper both the corporate income tax and the method how host country taxes are treated at home (the tax rule) are decision variables of governments. It is shown that the equilibrium allocation in a non-cooperative game, in which governments strategically set their fiscal policies, is independent of the tax rule. Since in equilibrium capital is inefficiently allocated we address the question whether tax cooperation can yield a Pareto-improvement. It is shown that tax rules heavily differ regarding the content of a cooperative contract. The credit method has the smallest requirement for a Pareto-improvement since neither a compensatory payment nor fully harmonized tax rates are necessary.

The paper is organized as follows: Section 2 presents the basic framework and discusses the assumptions of the model. Section 3 analyzes fiscal policy as outcome in a non-cooperative three-stage game in which governments choose a tax rule and a corporate income tax rate. The feasibility and the content of a cooperative contract between governments is investigated in section 4. Finally, section 5 summarizes with some conclusions.

## 2 The model

In this section the basic framework is introduced to analyze international corporate income tax competition. We start with the MacDougall-Kemp model which is according to Ruffin (1988) the simplest model to analyze international capital movements. This model was also used by Bond and Samuelson (1989). After presenting the free-trade equilibrium taxation is introduced.

### **Assumption 1** *The MacDougall-Kemp model*

*There are two countries, the home and the foreign country (all foreign variables are indexed with an asterisk). One good is produced by use of the factors capital  $K(K^*)$  and labor  $L(L^*)$  under conditions of perfect competition in all markets. The produc-*

tion function  $F(F^*)$  is homogeneous of degree one, strictly quasiconcave and satisfies additionally the Inada conditions. Each country has strictly positive endowments of capital and labor,  $(\bar{K}, \bar{K}^*, \bar{L}, \bar{L}^*)$ , which are inelastically supplied. However, capital is internationally mobile whereas labor is not. All foreign investment considered takes the form of equity-financed, real investment (foreign direct investment).<sup>2</sup>

We will assume that the return on investment in the home country is below that in the foreign country when no capital is traded, i.e.  $r = F_K[\bar{K}, \bar{L}] < F_K^*[\bar{K}^*, \bar{L}^*] = r^*$ , where  $r$  and  $r^*$  denote the rental rates for the use of capital. The reason for that could be a difference in the technology and/or in the endowments. An economically interesting and realistic case is the situation in which the home country has relatively more capital such that in autarky this leads, even when the home country's technology is superior, to a lower marginal product of capital. As a measure for the difference in the marginal product of capital in autarky the parameter  $c$  is introduced. Since labor is inelastically supplied and internationally immobile, it can be omitted in the production function for notational convenience. This allows to write

$$F_K[\bar{K}] \equiv c F_K^*[\bar{K}^*], \quad 0 < c < 1. \quad (1)$$

Equation (1) implies that in a free-trade situation home country firms will export capital and invest abroad.<sup>3</sup> The variable  $Z$  denotes net capital exports of the home country and depends on the technology and the factor endowments of both countries.  $Z > 0$  implies capital exports, and  $Z < 0$  represents capital imports for the home country. The reverse is true for the foreign country. In a free-trade equilibrium firms hire capital and labor until each labor market clears (and labor is paid its marginal product), world capital demand equals world capital supply and the following international capital market equilibrium condition holds

$$F_K[\bar{K} - Z^0] = F_K^*[\bar{K}^* + Z^0], \quad (2)$$

where  $Z^0 > 0$ . Because of the properties of the production functions there exists a unique equilibrium. The capital importing country has to pay for the use of foreign capital. This is done by trade in goods which is complementary to foreign direct investment. The repatriation of the returns on investment becomes effective through a trade surplus of the capital importing country, i.e. the capital exporting country can buy goods from the capital importing country which amounts to the value of repatriated earnings.

<sup>2</sup>The empirical evidence suggests that foreign direct investment is financed at least partly by host country sources. As analyzed by Sinn (1990), however, new foreign subsidiaries cannot be financed by retained profits, and usually get transfers of the parent firm, whereas for tax reasons in later phases retained earnings or host country sources are used.

<sup>3</sup>In this sense the present model investigates the location decision for a new production unit which is fully-owned by a (parent) company (Hartman (1985)). We do not analyze the case where the parent company changes its headquarters. Moreover, in this model foreign direct investment occurs because of country-specific advantages and not by some firm specific know-how, which is often used to explain the presence of multinationals.



We now introduce taxation into the model. The focus is on the modelling of some important aspects of a tax system which affect foreign investment. That is to say, we single out a corporate income tax rate and the tax rule fixed in a double taxation treaty as the starting point of a model.<sup>4</sup>

**Assumption 2** *Repatriation and corporate income taxation*

- (a) *The return on foreign investment net of the host country's corporate income tax is paid as dividend. No special withholding tax is levied at source.*
- (b) *All profits net of the host country's corporate income tax are repatriated to the home country.*

Part (a) excludes that the return on foreign investment is paid in form of interest or royalties. Therefore, the gross return on direct investment is equal to the marginal product of capital  $F_K(F_K^*)$ . Although withholding taxes exist, their relevance is limited, at least for western countries. Regarding the European Community the recent Council Directive (Council of the European Communities (1990)) states that distributed profits from a subsidiary of one member country to the parent firm of another member country are exempt from a withholding tax (Article 5). Equivalent assumptions to part (b) are either not to allow deferral or to see the investment period as infinite. The following assumption describes the set of fiscal instruments.

**Assumption 3** *The government's fiscal policy instruments*

- (a) *Each government has a unique corporate income tax rate,  $t \in [0, t_{max}]$ , where  $t_{max} < 1$ , and  $t^* \in [0, t_{max}^*]$ , where  $t_{max}^* < 1$ , respectively.*
- (b) *Each government applies one of three alternative rules how to treat foreign investment income: First, it can credit the foreign tax paid up to that amount which would have occurred under pure domestic taxation. This leads to the taxation at the higher of the two rates and is called the credit-cum-limitation method (ccl). Second, foreign investment income can be completely exempted from domestic taxation, such that only the foreign tax matters, which is called the exemption method (ex).<sup>5</sup> Finally, the government can allow the foreign tax to be deducted as expenses before the domestic corporate tax is applied. This is called the deduction method (ded).*

Part (a) implies a zero government revenue constraint. The case of maximum tax rates equal to one are discussed below. The second part of the assumption is a description of existing tax rules (Giovannini (1989)). Of course, much more complex

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<sup>4</sup>The incorporation of inflation effects, problems of inventory valuation, the possibility of loss carry overs, investment incentives, the treatment of exchange rate gains/losses, depreciation rules etc., which is well known from the literature on taxation and the investment decision, is possible and remains on the research agenda.

<sup>5</sup>This is sometimes called "international affiliation privilege".

and elaborated credit rules could be created, but from a practical and political point of view the three rules quite well reflect reality. Hence, for a parent firm in the home country the net-of-tax return on a direct investment in the foreign country depends on the applied tax rule

- credit-cum-limitation method:  $\{1 - \max(t, t^*)\} F_K^*$ ,

- exemption method:  $(1 - t^*) F_K^*$ ,

- deduction method:  $(1 - t)(1 - t^*) F_K^*$ .

The net return for a foreign firm investing in the home country can analogously be written. Corporate taxation according to different tax rules changes the capital market equilibrium. To study the effects of taxation on the capital market equilibrium, let us assume for the moment that  $Z > 0$ , i.e. the home country exports capital. For each tax rule the respective equilibrium condition is

$$(ccl) \quad (1 - t) F_K[\bar{K} - Z(t, t^*)] = \{1 - \max(t, t^*)\} F_K^*[\bar{K}^* + Z(t, t^*)] \quad (3a)$$

$$(ex) \quad (1 - t) F_K[\bar{K} - Z(t, t^*)] = (1 - t^*) F_K^*[\bar{K}^* + Z(t, t^*)] \quad (3b)$$

$$(ded) \quad (1 - t) F_K[\bar{K} - Z(t, t^*)] = (1 - t)(1 - t^*) F_K^*[\bar{K}^* + Z(t, t^*)]. \quad (3c)$$

Foreign direct investment is carried out until the net return on domestic and foreign investment for the home country firm is the same. If the home country imports capital,  $Z < 0$ , depending on the tax rule one of the following conditions must hold

$$(ccl) \quad (1 - t^*) F_K^*[\bar{K}^* + Z(t, t^*)] = \{1 - \max(t, t^*)\} F_K[\bar{K} - Z(t, t^*)] \quad (4a)$$

$$(ex) \quad (1 - t^*) F_K^*[\bar{K}^* + Z(t, t^*)] = (1 - t) F_K[\bar{K} - Z(t, t^*)] \quad (4b)$$

$$(ded) \quad (1 - t^*) F_K^*[\bar{K}^* + Z(t, t^*)] = (1 - t^*)(1 - t) F_K[\bar{K} - Z(t, t^*)]. \quad (4c)$$

Foreign country firms invest abroad, i.e. in the home country, until the net return of domestic and investment abroad is equalized. Note that for firms in the host country (for  $Z > 0$  these are the foreign country firms, and for  $Z < 0$  these are the home country firms) the net return on the investment in their country is not less than the return on investment abroad.<sup>6</sup>

Alternatively, the equilibrium could be characterized by  $Z = 0$ . In the previous two cases ( $Z \neq 0$ ), the net return on domestic and foreign investment was equal in equilibrium for firms in (at least) one of the two countries. For  $Z = 0$  this is not necessarily the case. Consider the situation in which investment in the home country is made by the firms of this country and by the foreign firms through direct

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<sup>6</sup>Eventually, these firms would like to borrow at the net rate of return, which the capital exporting country's firm earn, to invest domestically. Since this is excluded, the capital exporting country's firms determine the equilibrium.

investment. Due to taxation, the net return of home country firms can differ from the net return of foreign country firms. Therefore, it can happen that the strategy to invest all domestically owned capital domestically yields a strictly higher return than any investment abroad for firms in both countries.<sup>7</sup>

On the other hand, when no capital is traded, the net return for domestic and investment abroad can be equal for firms in one or both countries. Then, the respective equilibrium conditions in (3) and/or (4) hold with equality for  $Z = 0$ . A good example is the case where both countries apply the exemption method and tax rates are such that  $(1 - t^*) = (1 - t)c$ .

A unique capital market equilibrium with respect to  $Z$  also exists in the case with taxation. Taxation according to any rule is simply a monotone and continuous transformation of the marginal productivity curves. Although it might occur that investing completely domestically is preferable for all firms in both countries, it can never happen that (3) and (4) can be fulfilled for different  $Z$  simultaneously.<sup>8</sup> Therefore, a  $Z(t, t^*)$  exists which ensures a unique equilibrium.

If taxes influence capital flows (which is not the case for (3a) if  $t > t^*$  and for (4a) if  $t^* > t$ ), increasing the corporate income tax always drives capital out of the country. That is to say,  $Z$  increases (decreases) if the home (foreign) country increases its tax rate. Two different cases have to be considered. First, both countries tax rates influence  $Z$ . This is the case in (3a) for  $t < t^*$ , (3b), in (4a) for  $t > t^*$  and (4b). Then, by total differentiation of the capital market equilibrium the following derivatives result

$$Z_t = \frac{-F_K}{(1-t)F_{KK} + (1-t^*)F_{KK}^*} = \frac{Z\epsilon\epsilon^*}{(1-t)(\epsilon + \epsilon^*)} > 0, \quad (5)$$

$$Z_{t^*} = \frac{F_K^*}{(1-t)F_{KK} + (1-t^*)F_{KK}^*} = \frac{-Z\epsilon\epsilon^*}{(1-t^*)(\epsilon + \epsilon^*)} < 0, \quad (6)$$

where use of the definition of the elasticity of supply and demand of exported capital  $\epsilon \equiv -F_K/F_{KK}Z$  and  $\epsilon^* \equiv -F_K^*/F_{KK}^*Z$  has been made (for  $Z \neq 0$ ). These relate the relative change in net capital exports to a relative change in the gross return, i.e. the marginal product of capital. When the home country exports capital ( $Z > 0$ ), then  $\epsilon > 0$  denotes a capital supply elasticity, whereas in case of  $Z < 0$ ,  $\epsilon < 0$  is a

<sup>7</sup>To demonstrate such a case suppose that the home country applies the exemption method and tax rates are such that  $(1-t)F_K[\bar{K}] > (1-t^*)F_K^*[\bar{K}^*]$ . Clearly, investing abroad is not profitable for home country firms, since the marginal loss on the left hand side is larger than the marginal gain on the right hand side. If the foreign country applies the deduction method and if the following inequality holds  $(1-t^*)F_K^*[\bar{K}^*] > (1-t^*)(1-t)F_K[\bar{K}]$ , then the equilibrium is characterized by  $Z = 0$ . The preceding two inequalities imply  $1 > (1-t)c > (1-t^*)$ , which is by assumption a possible configuration of the parameter  $c$  and tax rates.

<sup>8</sup>No formal proof is given here. However, the statement can be verified by checking for every tax rule combination that domestic investment cannot be strictly inferior for firms in both countries at the same time.

demand elasticity, and vice versa for the foreign country. In the second case only one of the tax rates matters. In case (3c), only the foreign tax rate matters whereas in case (4c) only the home tax rate matters. As above, the relevant tax rate drives capital out of the country.<sup>9</sup>

### 3 Non-cooperative fiscal policy

As outlined in the introduction corporate income taxes have been lowered in most western countries during the last decade.<sup>10</sup> This process is often called (corporate) tax competition and it seems natural to identify this with non-cooperative behavior. Therefore, it is interesting and necessary to make tax rates an endogenous government decision variable. However, corporate income tax changes by governments are embedded within existing rules for double taxation. Hence, tax rules should also be a decision variable of each government. Although the tax rate and the tax rule are both elements of a tax system, they are distinct in nature. The decision on a tax rule is a long-run decision since compared to the corporate tax rate the tax rule is less often changed. Foreign direct investment is more sensitive to tax rules than to tax rates because the latter affect both domestic and foreign investment equally, whereas the former apply only to foreign direct investment.

Following Bond and Samuelson (1989), it is assumed that governments maximize real national income which is defined as the sum of domestic output and the saldo of net capital transfers. For  $Z > 0$ , national income of the home and the foreign country, respectively, are therefore

$$Y = F[\bar{K} - Z(t, t^*)] + (1 - t^*) F_K^*[\bar{K}^* + Z(t, t^*)] Z(t, t^*) \quad (7)$$

$$Y^* = F^*[\bar{K}^* + Z(t, t^*)] - (1 - t^*) F_K^*[\bar{K}^* + Z(t, t^*)] Z(t, t^*). \quad (8)$$

The following three-stage game endogenizes the corporate income tax rate and the tax rule. All actions taken by governments are observable in subsequent stages. The structure of the game is as follows

**First stage:** Governments simultaneously choose a tax rule

**Second stage:** Governments simultaneously choose a corporate income tax rate

**Third stage:** Market equilibrium is determined.

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<sup>9</sup>The derivatives can be identically written in elasticities as in (5) and (6), respectively. However, in that case  $Z$ ,  $\epsilon$  and  $\epsilon^*$  depend only on one of the two tax rates.

<sup>10</sup>A drastic example is Sweden where the corporate income tax rate was reduced from 52% to 30% in 1991.

Choosing a tax rule is a unilateral action, and therefore a simultaneous decision by both governments is not self-evident. From a theoretical point of view, a Stackelberg game is hard to justify. Who moves first and why? The leader should have the opportunity to change the rule after the other government has decided. A similar argument can be made for the case of simultaneous choice in the second stage.<sup>11</sup>

The reason why both governments choose a tax rule in the first stage is that capital flows not always from the home to the foreign country. There exist tax rule and tax rate combinations which switch the home country, the 'potential' capital exporter, into a net capital importer. The following lemma is necessary to prove the full game since it characterizes the third stage of the game.

**Lemma 1** *The direction of net capital flows*

*The home country imports capital ( $Z < 0$ ) if and only if the foreign country applies the exemption method and  $t^* > 1 - (1 - t)c$ .*

Proof: If the foreign country applies (*ex*), the condition on tax rates implies  $Z < 0$  since  $(1 - t)c > (1 - t^*) \Leftrightarrow (1 - t) F_K[\bar{K}] > (1 - t^*) F_K^*[\bar{K}^*]$ .

To prove the other direction, it follows immediately by the above argument that for  $t^* \leq 1 - (1 - t)c$  the foreign country will not invest abroad under (*ex*). If the foreign country applies (*ccl*) or (*ded*), then  $Z$  can never be negative. This will be proved by contradiction. Assume that the foreign country applies (*ccl*) and  $Z < 0$ . Then it must hold  $(1 - t^*) < \{1 - \max(t, t^*)\}c$ . If  $t \leq t^*$ , it follows that  $1 < c$ , which is not possible by assumption.  $t > t^*$ , however, would require  $(1 - t^*) < (1 - t)c$ , or at least  $(1 - t^*) < (1 - t)$ . But this implies  $t < t^*$ , a contradiction. Assume that the foreign country applies (*ded*).  $Z < 0$  requires  $1 < (1 - t)c$ , which is impossible.  $\square$

There is a good intuition for the result. The reversal of net capital flows cannot occur if the foreign country applies (*ded*) or (*ccl*). The difference in the marginal product of capital, which already exists without taxation, is not compensated by taxes because under (*ded*) the foreign tax  $t^*$  does not matter, whereas under (*ccl*) – if it matters – it is below that in the home country. The exemption method, which for given tax rates and capital flows yields the highest net return, is however not sufficient for a reversal. Since in this case  $t^*$  does not affect the net return on the investment abroad, only a sufficiently high foreign tax rate discriminates investment in the foreign country and leads to  $Z < 0$ . The Lemma implies that a 'potential' capital importer can preserve that status independent of  $c$  and the tax rates by sticking to the deduction or the credit method. Hence, cases (4a) and (4c), where

<sup>11</sup> Gordon (1990) compares Cournot and Stackelberg-equilibria in tax rate games. However, he admits (1990, p.14) that past changes in corporate income tax rates have occurred rather simultaneously.

$Z < 0$  was assumed, are not compatible with an equilibrium. We are now in a position to characterize the equilibrium of the full game.

**Proposition 1** *Endogenous fiscal policy in a non-cooperative game*

*For every combination of tax rules the subgame Nash-equilibrium in tax rates yields the same national income pair  $\{\tilde{Y}, \tilde{Y}^*\}$  and the same capital flow  $\tilde{Z}$ , where  $0 < \tilde{Z} < Z^0$ . The equilibrium tax rates are*

$$\tilde{t}^* = \frac{1}{1 + \epsilon}, \quad \tilde{t} \begin{cases} = 0 & \text{if the home country chooses (ex) or (ccl)} \\ \in [0, t_{max}] & \text{if the home country chooses (ded)}. \end{cases}$$

*The foreign country improves whereas the home country loses compared to the free-trade equilibrium.*

The proof of the surprising result that governments are indifferent which rule to choose, is relegated to the appendix. Here we try to give an intuition. For any home tax rate the foreign country faces the following trade-off. By increasing its tax  $t^*$  the foreign country lowers the return which has to be paid to the home country. However, it also reduces capital inflows which drives up the marginal product of capital and reduces revenues. For small increases above zero raising the tax is always welfare improving for the foreign country. Why does the foreign country find a reversal of capital flows not optimal (recall from lemma 1 that the foreign country effectively controls the sign of  $Z$ ) ? If a reversal occurs foreign capital owners are indifferent in equilibrium between inward and outward investment. However, to induce such a situation the foreign tax rate has to be higher than the home tax rate which means that from the foreign country's point of view the marginal gain from a unit of capital in the own country is higher than from abroad.

Now consider the home country. Why is  $\tilde{t} = 0$  optimal under (ex) and (ccl)? Take first the case when the home country is a capital importer. Then, for similar reasons as above a positive tax rate  $t$  would be optimal. However, we have seen that the foreign country does not allow for such a situation. Given that capital flows out of the home country and confronted with bad terms of trade due to a positive foreign tax rate, the dominant strategy for the home country is not to drive even more capital out of the country by increasing its own tax and thereby lowering the return on the existing capital exported.

Under (ded) the home country tax does not matter for the location of capital. The home tax rate simply redistributes income from the capital owners to the government which does not affect national income. Again, the foreign tax rate determines the capital market equilibrium. Since the capital flow and the foreign tax

rate are the same in all subgames, the pair of national income is the same.<sup>12</sup> The foreign country improves upon the free-trade equilibrium since its tax rate is positive although  $\tilde{t} = 0$ . Since free-trade is equivalent to joint output maximization, the home country must be worse off.

#### 4 Can fiscal cooperation be Pareto-improving?

The fact that the non-cooperative Nash-equilibrium is not optimal regarding the capital allocation, raises the question whether the two governments can agree on a cooperative contract which improves the welfare of both countries. Of course, if the government had a lump-sum tax, then - with zero corporate taxes and a compensatory payment from the home to the foreign country - this would be possible. However, the more interesting and relevant question is whether there exists a contract without a compensatory payment by the home country and with a minimum requirement on tax rate harmonization.<sup>13</sup> In this context a cooperative contract specifies a tax rule and tax rate combination such that national income levels are higher than in the Nash-equilibrium and capital is efficiently allocated. This is illustrated in *figure 1* where the line passing through the free-trade equilibrium with slope  $-1$  describes the set of Pareto-optimal allocations in the economy and the shaded area contains the set of allocations improving upon the Nash-equilibrium.<sup>14</sup>

To investigate the problem, we first look for fiscal policies which are compatible with free-trade capital flows. The free-trade equilibrium yields an efficient capital allocation since there is no difference between the social and the private return on investment. With taxation this is usually no longer true. However, under each tax rule chosen by the home country there exist tax rate combinations such that free-trade capital flows occur. Under exemption this is the case for  $t = t^*$ , under credit for  $t \geq t^*$ , and under deduction  $t^* = 0$  must hold. The reason is straightforward. Capital is efficiently allocated if in equilibrium the marginal return on capital is equal in both countries. This is satisfied if for each tax rule in equation (3) taxes cancel. Very often identical tax rates are claimed to be necessary to achieve an efficient allocation. As can be seen now, efficiency critically depends on the tax rule that is applied. Identical tax rates are sufficient for efficiency only if the home country

<sup>12</sup>Maximum tax rates equal to one were excluded. If one were assume that no capital is traded when the return is zero autarky would be a second Nash-equilibrium under the credit and the deduction method adopted by the home country. However, since income levels are higher under the trade in capital equilibrium than under autarky (this directly follows from the properties of the production functions), the former equilibrium Pareto-dominates the second.

<sup>13</sup>Hamada (1966) was the first author who analyzed non-cooperative fiscal policy equilibria and cooperation. However, he analyzed only the exemption method when governments behave non-cooperatively and only the credit method when cooperation takes place. Moreover, he did not impose a zero government revenue constraint, which yields negative tax rates for the home country in a non-cooperative equilibrium.

<sup>14</sup>It is assumed that the Nash-equilibrium is the threat point, i.e. the outside option of both governments. There is no way to restrict capital flows by direct controls in order to change the threat point.

chooses (*ccl*) or (*ex*). It is also necessary under (*ex*), but it is neither necessary nor sufficient under the deduction method.

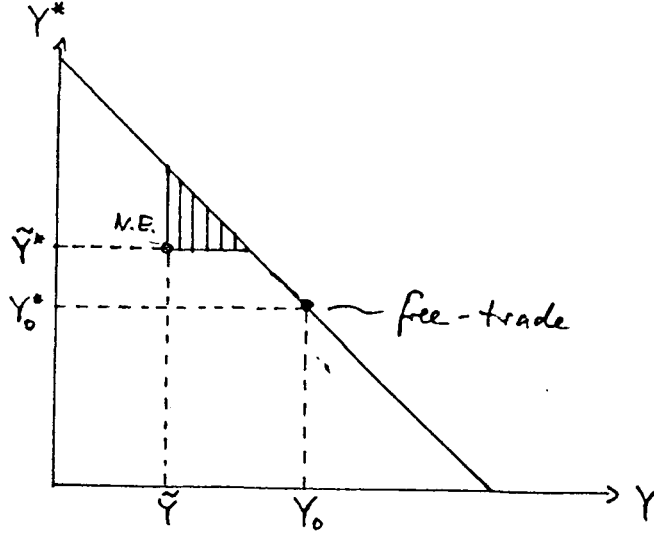


figure 1

Under the requirement of an efficient tax structure national income levels ( $Y_E, Y_E^*$ ) are equivalent to free-trade income levels ( $Y_0, Y_0^*$ ) only for some particular tax rate constellations. When the home country adopts the exemption or credit method the following relationship holds

$$Y_E^{ex} = Y_E^{ccl} = F[\bar{K} - Z^0] + (1 - t^*) F_K^*[\bar{K}^* + Z^0] Z^0 \leq Y_0, \quad (9)$$

$$Y_E^* = F^*[\bar{K} + Z^0] - (1 - t^*) F_K^*[\bar{K}^* + Z^0] Z^0 \geq Y_0^*, \quad (10)$$

where equality holds in (9) and (10) if  $t^* = 0$ . Exemption and credit method are equivalent under efficient tax structures as far as national income is concerned. Of course, for a given foreign tax rate the distribution of the net-of-foreign-tax return between the home country government and the capital owner under the two rules differ. However, under the deduction method a zero foreign tax rate is a necessary condition to reach efficiency. Hence, we can directly conclude that under the deduction method there never exists a cooperative contract which allows a Pareto-improvement and an efficient capital allocation.

We next investigate the exemption method chosen by the home country since the condition on tax rates for efficiency is a subset of the permissible set of tax structures under the credit method. The question is whether there exist equal tax rates  $t = t^*$  such that at least the lower right corner of the shaded area in figure 1



is attainable, that is formally

$$Y_E^* \geq \tilde{Y}^* = F^*[\bar{K}^* + \tilde{Z}] - (1 - \tilde{t}^*) F_K^*[\bar{K}^* + \tilde{Z}] \tilde{Z}. \quad (11)$$

$Y_E^*$  is monotonically increasing in  $t^*$ . Clearly, for  $t^*$  close to one  $Y_E^*$  converges to  $F^*[\bar{K}^* + Z^0]$  which is larger than the right hand side of (11) since from Proposition 1 follows  $Z^0 > \tilde{Z}$ . However, can all efficient Pareto-improvements be implemented? If this is the case it must hold

$$Y_0 + Y_0^* - \tilde{Y} < Y^*|_{t=t^*-1} \quad (12)$$

which is equivalent to

$$F[\bar{K} - Z^0] - F[\bar{K} - \tilde{Z}] - (1 - \tilde{t}) F_K^*[\bar{K}^* + \tilde{Z}] \tilde{Z} < 0. \quad (13)$$

The strict inequality is fulfilled because home country output is smaller under free-trade than in the non-cooperative Nash-equilibrium. We conclude that under the exemption method adopted by the home country a cooperative contract could be implemented. Of course, this is also possible under the credit method since  $t = t^*$  is a special case of the efficient tax structures under the credit method. Moreover, any home tax rate above the necessary foreign tax rate which is required to achieve a point on the line of the shaded area is allowed. We summarize these results in the following proposition.

**Proposition 2** *Pareto-improving fiscal cooperation*

*Only under the credit and the exemption method adopted by the home country a cooperative contract exists which implements all efficient and individual rational allocations. Whereas the exemption method requires identical tax rates, the credit method allows for home country tax rates higher than the necessary foreign tax rate.*

## 5 Conclusions

In this paper we analyzed how the international capital allocation is influenced by different tax rates and tax rules. Foreign direct investment was identified with a fully equity-financed capital transfer of a parent to its subsidiary. In contrast to most of the literature it is assumed that the government controls only one important short-run tool, the corporate income tax. Foreign owned capital cannot be discriminated and no special withholding tax on repatriated earnings is levied. This corresponds to the present situation in western economies where withholding taxes are very low or zero (as for intra-EC distributed profits).<sup>15</sup> We consider three different rules how

<sup>15</sup> According to the OECD Model Double Taxation Convention of 1977, which proposes upper limits for withholding taxes (5% on dividends under sufficient ownership, 15% on portfolio investment), most western countries have indeed rather low withholding taxes (OECD (1990)).

taxes paid in the host country are treated at home: the credit method, the exemption method and the deduction method. Tax rates and tax rules differ since the decision on the latter is a long-run decision and is less frequently changed compared to the former which is more a short-run decision. These assumptions imply that host country taxes are credited or deducted at home at the same corporate tax rate that also applies to purely domestic investment.

In this paper the non-cooperative Nash-equilibrium with respect to tax rules and tax rates was analyzed. It turns out that all different tax rule combinations lead to the same pair of national income levels. The corporate tax rate of the country which is the capital exporter in a free-trade situation, is driven down to zero. The other country can exploit its advantage and sets a positive corporate tax rate. Thereby, capital is not efficiently allocated in equilibrium. The result is in contrast to Bond and Samuelson (1990), where exported capital can be fully discriminated. In their model the deduction method was preferred to the credit method since the former allows trade in capital but not the latter. However, this form of discrimination is not realistic and trade in capital can be observed under the credit method.

Although non-cooperative behavior seems to fit well the idea of tax competition the question is why governments do not cooperate. In fact, double taxation treaties could be understood as a *quid pro quo*, in which governments agree on tax rules and tax rates which gives benefits to both countries. This line was investigated in the present paper. It was shown that only under the exemption and the credit method adopted by the home country all efficient allocations which yield an improvement upon the non-cooperative Nash-equilibrium for both countries can be implemented. This is not possible for the deduction method since the condition for an efficient capital allocation requires a zero foreign tax rate. Since the foreign country has to be compensated to accept a cooperative solution it is not possible to redistribute income between the two countries without an explicit transfer payment.

Under the exemption and credit method a cooperative contract specifies beside the tax rule adopted by the home country also corporate tax rates. The clear advantage of the credit method against to the exemption method is that no full tax rate harmonization is necessary as under exemption. In this sense the EC Council Directive of July 1990 (Council of the European Communities (1990)) which allows for the credit and the exemption method only (Article 4) seems to be a good decision. The Directive was intended to lower double taxation for given capital flows. In the light of the above result, however, the merit of the two rules is to make an individual rational and efficient allocation possible through cooperation.

## Appendix

### Proof of Proposition 1:

We derive the Nash-equilibria in all nine subgames. From Lemma 1 follows that the foreign country's choice for (*ccl*) and (*ded*) does not induce foreign firms to invest in the home country. Cases [*ccl, ded*] and [*ccl, ccl*], cases [*ex, ccl*] and [*ex, ded*], and cases [*ded, ccl*] and [*ded, ded*], respectively, are therefore identical.<sup>16</sup> Only six subgames have to be considered.

#### Subgame 1 – [*ded, ded/ccl*]

From Lemma 1 it is known that  $Z \geq 0$ . Home country firms invest abroad if

$$\begin{aligned} (1-t) F_K[\bar{K}] &< (1-t)(1-t^*) F_K^*[\bar{K}^*] \\ \Leftrightarrow \quad c &< (1-t^*). \end{aligned} \tag{A1}$$

Foreign investment and national incomes are therefore only a function of  $t^*$ .

$$Z(t^*) \quad \begin{cases} > 0 & \text{if } 0 \leq t^* < 1-c \\ = 0 & \text{if } 1-c \leq t^* \leq t_{max}^*. \end{cases} \tag{A2}$$

Hence, the home country's reaction function is the entire box spanned by  $t$  and  $t^*$ . When (A1) holds maximization of  $Y^*$ , as defined in (8), with respect to  $t^*$  gives

$$Y_{t^*}^* = F_K^* Z + [-(1-t^*) F_{KK}^* Z + t^* F_K^*] Z_{t^*} = 0. \tag{A3}$$

Using (3c) and (6), this leads to  $\hat{t}^* = 1/(1+\epsilon)$ ,  $\epsilon = \epsilon(t^*) > 0$ . It can easily be seen that a foreign tax rate, which eliminates trade in capital, is not optimal since the derivative

$$\lim_{t^* \rightarrow 1-c} Y_{t^*}^* = t^* F_K^* Z_{t^*} < 0 \tag{A4}$$

indicates that a decrease of  $t^*$  is welfare improving. This allows to draw the reaction function for each country as illustrated in *figure A-1*.<sup>17</sup> The horizontal line characterizes the set of Nash-equilibria which yield the same pair of national income.

<sup>16</sup>The first term in brackets always refers to the home country, the second terms refer to the foreign country.

<sup>17</sup>The figures are drawn for the case  $t_{max} = t_{max}^*$ .

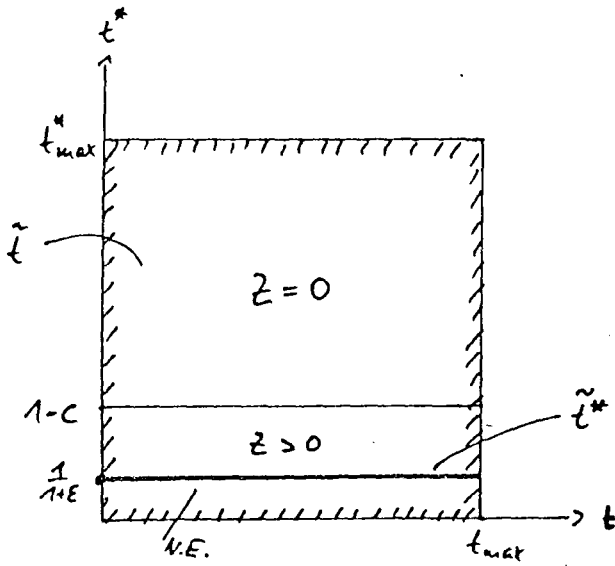


figure A-1

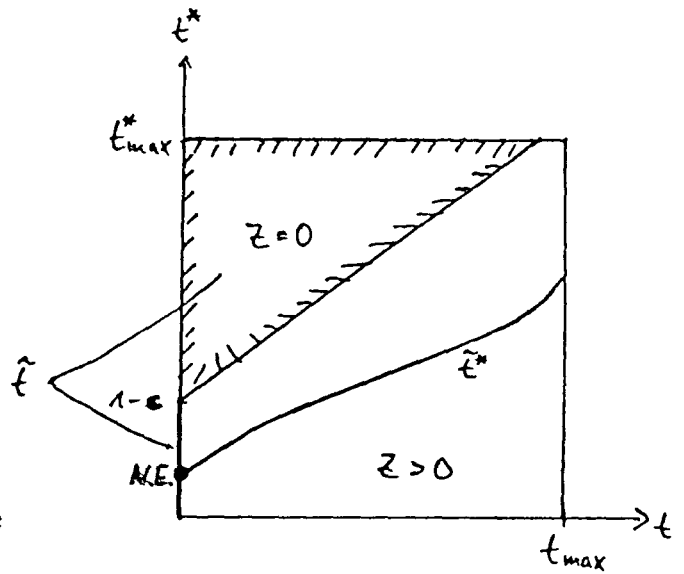


figure A-2

### Subgame 2 - [ex,ded/ccf]

Lemma 1 allows to restrict attention to the calculus of home country firms. They invest abroad if

$$(1-t) F_K[\bar{K}] < (1-t^*) F_K^*[\bar{K}^*]. \quad (A5)$$

which shows capital flows and national incomes dependent on both tax rates

$$Z(t, t^*) \begin{cases} > 0 & \text{if } 0 \leq t^* < 1 - (1-t)c \\ = 0 & \text{if } 1 - (1-t)c \leq t^* \leq t_{max}^*. \end{cases} \quad (A6)$$

As can be seen in figure A-2 the combinations of tax rates which lead to no trade in capital are only a subset of the respective set in figure A-1. The reaction functions can be derived by maximization of (7) and (8), respectively, using (3b), (5) and (6). This leads for the foreign country to the same derivative and optimal tax rate as in the previous subgame (A3) although  $Z$  and  $\epsilon$  are functions of both tax rates now. For the home country follows when (A5) holds

$$Y_t = [(1-t^*) F_{KK}^* Z - t F_K] Z_t < 0 \quad (A7)$$

such that the reaction function can be written as

$$\tilde{t} \begin{cases} = 0 & \text{if } 0 \leq t^* < 1 - c \\ \in [0, 1 - \frac{(1-t^*)}{c}] & \text{if } 1 - c \leq t^* \leq t_{max}^* \end{cases} \quad (A8)$$

Clearly, for a high foreign tax rate home country firms find more investment abroad profitable since under exemption only domestic investment is disfavored by the home

country tax rate. To induce capital inflows is always profitable for the foreign country. It pays less than it benefits from capital inflows. For the home country a positive tax rate is not optimal while capital flows out, because the terms of trade are worsened and the domestic tax base is reduced. Although the slope of the foreign country's reaction function is unknown, the optimal  $t^*$  is always in the area of  $Z > 0$  since the same argument applies as above.<sup>18</sup> For  $t = 0$ , the optimal foreign tax rate takes the same value as when the home tax rate plays no role as in subgame 1. The unique Nash-equilibrium in this subgame is  $[0, 1/(1 + \epsilon)]$ .

### Subgame 3 – $[ccl, ded/ccl]$

Capital flows to the foreign country if

$$(1 - t) F_K[\bar{K}] < \{1 - \max(t, t^*)\} F_K^*[\bar{K}^*], \quad (A9)$$

which leads to the same conditions for capital flows as in (A6). For  $t > t^*$ , foreign investment is carried out and the capital market is in equilibrium if equation (2) holds; hence  $Z = Z^0$ . Clearly, it is in the interest of the foreign country to raise its tax rate up to the home tax rate since a positive revenue effect but no negative tax base effect occurs ( $Y_t^* = F_K^* Z^0$ ). For  $t < t^*$  the capital market equilibrium condition is the same as in subgame 2. There, the reaction function of the foreign country might intersect the  $t = t^*$  line since a too high foreign tax rate reduces the tax base and worsens the terms of trade. In contrast, in the present subgame the foreign country never reduces its tax rate below  $t$ . For small  $t$  the foreign reaction function looks like in subgame 2, and the optimal tax rate has the value  $1/(1 + \epsilon)$ . Hence the complete reaction function can be written as

$$\hat{t}^* = \max(t, \hat{t}^*), \quad \text{where} \quad \hat{t}^* \equiv \arg \max_t Y^* \quad \text{s.t.} \quad (3b). \quad (A10)$$

The home tax rate  $t$  does not influence the allocation for  $t^* > 1 - (1 - t)c$ , or for  $t \geq t^*$ , since in the former case  $Z = 0$ , and in the latter case  $Z$  is independent of  $(t, t^*)$  as was shown above. Elsewhere an increase in the home country's tax rate reduces welfare as in (A7) (up to the point where no further foreign investment occurs and welfare remains constant). This leads to the following reaction function

$$\hat{t} \begin{cases} = 0 & \text{if } 0 \leq t^* < 1 - c \\ \in [0, 1 - \frac{(1-t^*)}{c}] & \text{if } 1 - c \leq t^* \leq t_{max}^*. \end{cases} \quad (A11)$$

<sup>18</sup> Applying the implicit function rule to the foreign reaction function yields  $(d\hat{t}^*/dt) = -\epsilon_t/[(1 + \epsilon)^2 + \epsilon_{t^*}]$ . The slope of the reaction function depends on the sign of the partial derivatives  $\epsilon_t$  and  $\epsilon_{t^*}$ , which involve third derivatives of the production function.

Subgame 3 is depicted in figure A-3. The Nash-equilibrium is unique  $[0, 1/(1 + \epsilon)]$ .

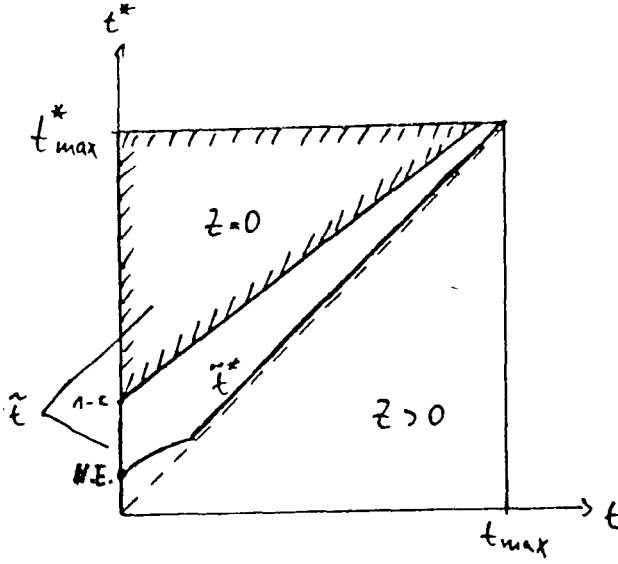


figure A-3

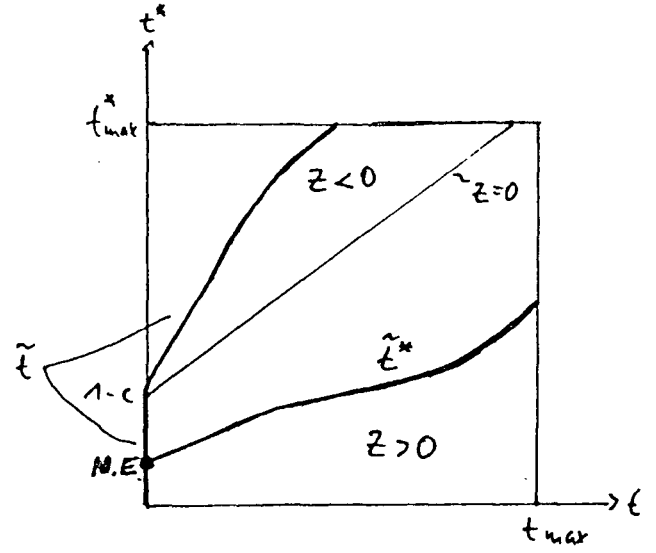


figure A-4

#### Subgame 4 - $[ex, ex]$

This is the realization of the source principle. The sign of  $Z$  is determined by the following relation

$$(1-t)F_K[\bar{K}] \gtrless (1-t^*)F_K^*[\bar{K}^*]. \quad (A12)$$

Therefore,

$$Z(t, t^*) \begin{cases} > 0 & \text{if } 0 \leq t^* < 1 - (1-t)c \\ = 0 & \text{if } 1 - (1-t)c = t^* \\ < 0 & \text{if } 1 - (1-t)c < t^* \leq t_{max}^* \end{cases} \quad (A13)$$

As can be seen in figure A-4, the area north-west of the separating line  $t^* = 1 - (1-t)c$  now leads to  $Z < 0$ . To derive the home country's reaction function requires to distinguish between the different areas. For  $Z > 0$ , the government maximizes (7) with respect to  $t$ , which yields by using (3b) and (5) the same derivative as in the second subgame, (A7). As above, for  $t^* \leq 1 - c$  the optimal home tax rate is zero. For a high foreign tax rate, the optimal  $t$  will induce capital inflows. For  $Z < 0$ , the government of the home country maximizes national income which is defined as

$$Y = F[\bar{K} - Z] + (1-t)F_K[\bar{K} - Z]Z. \quad (A14)$$

Using (4b) and (5), the optimal tax rate can be written

$$\tilde{t} = \frac{1}{1 - \epsilon^*} > 0, \quad \epsilon^* < 0, \quad \text{for } Z < 0. \quad (A15)$$

Now consider the foreign country. For  $Z > 0$ , maximization of (8) with respect to  $t^*$ , using (3b) and (6), yields the same result as in subgame 2. For  $Z < 0$ , the foreign country maximizes

$$Y^* = F^*[\bar{K}^* + Z] - (1 - t) F_K[\bar{K} - Z] Z. \quad (A16)$$

Using (4b) and (6) gives

$$Y_{t^*}^* = [(1 - t) F_{KK} Z + t^* F_K^*] Z_{t^*} < 0, \quad (A17)$$

which shows that the foreign reaction function is like that in subgame 2. Therefore, the unique Nash-equilibrium is  $[0, 1/(1 + \epsilon)]$ .

#### Subgame 5 – [ded, ex]

Foreign investment from the home in the foreign country occurs if (A1) holds. Capital flows from the foreign to the home country if

$$(1 - t^*) F_K^*[\bar{K}^*] < (1 - t) F_K[\bar{K}]. \quad (A18)$$

It follows

$$Z(t, t^*) \begin{cases} > 0 & \text{if } 0 \leq t^* < 1 - c \\ = 0 & \text{if } 1 - c \leq t^* \leq 1 - (1 - t)c \\ < 0 & \text{if } 1 - (1 - t)c < t^* \leq t_{max}^*. \end{cases} \quad (A19)$$

The home reaction function can be constructed from other subgames. For  $t^* \leq 1 - c$ , the home tax rate does not matter and the reaction function is identical to that one in the relevant area in subgame 1. For  $t^* > 1 - c$  the optimal tax rate induces  $Z < 0$  and is therefore as in subgame 4

$$\tilde{t} \begin{cases} \in [0, t_{max}] & \text{if } 0 \leq t^* \leq 1 - c \\ \frac{1}{1 - \epsilon} & \text{if } 1 - c < t^* \leq t_{max}^*. \end{cases} \quad (A20)$$

A similar conclusion can be drawn for the foreign reaction function. It is always profitable to induce a positive  $Z$ , as can be seen from subgame 4 (the enlarged region of  $Z = 0$  in the present case does not change the conclusion qualitatively). In this area the optimal value is  $\tilde{t}^* = 1/(1 + \epsilon)$ , which is independent of  $t$ . The reason is straightforward. Even without considering  $t$ , the gross marginal product of capital in the home country is lower than in the foreign country. There is a set of Nash-equilibria  $[(0, t_{max}), 1/(1 + \epsilon)]$ , depicted in *figure A-5*, which all yield the same national income levels.

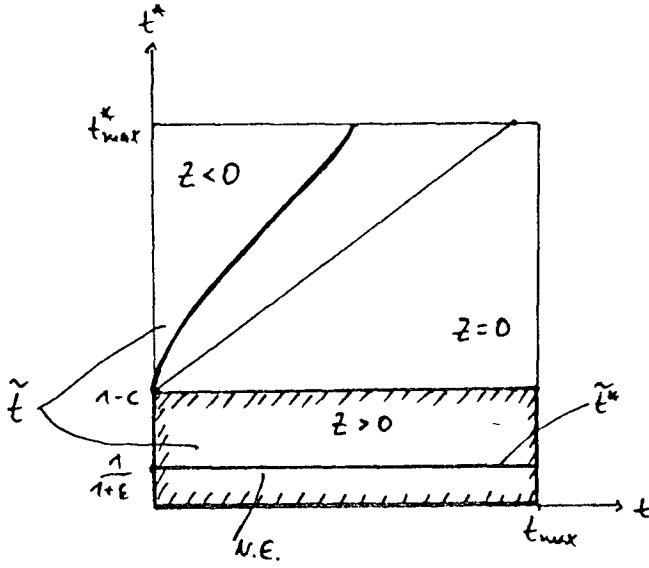


figure A-5

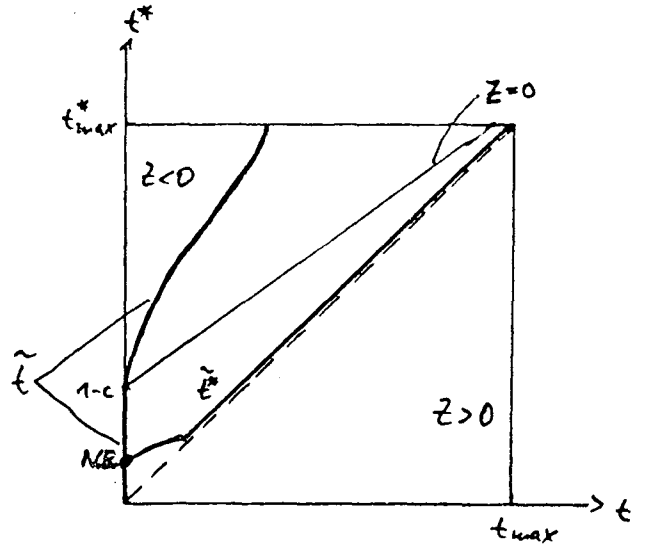


figure A-6

#### Subgame 6 - [ccl, ex]

Capital flows from the home to the foreign country if (A9) holds and in the other direction if (A18) is fulfilled. A necessary and sufficient condition for  $Z = 0$  is  $t^* = 1 - (1 - t)c$ . Therefore, the conditions on parameters for capital flows is identical to the case of subgame 4, that is (A13). The home reaction function is for  $t^* \leq 1 - c$  as in subgame 3, for  $t^* > 1 - c$  – see the result of subgame 5 – it is  $\tilde{t} = 1/(1 + \epsilon)$ . The foreign reaction function can be constructed from subgame 4 (for  $Z < 0$ ) and subgame 3 (for  $Z \geq 0$ ). It is identical to the reaction function in subgame 3, since the possibility of  $Z < 0$  even worsens the situation of the foreign country. As shown in figure A-6, the only Nash-equilibrium is therefore  $[0, 1/(1 + \epsilon)]$ .

The equilibrium tax rates in each subgame induce the same  $\tilde{Z}$  which is clearly below  $Z^0$  (recall equation (6)). Hence, the same income pair  $[\tilde{Y}, \tilde{Y}^*]$  is induced.

□



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University of Konstanz  
Sonderforschungsbereich 178  
"Internationalization of the Economy"

**Workshop on  
International Political Economics of Taxation**

July 2-3, 1992  
University of Konstanz  
Großer Sitzungssaal, V 1001

**Thursday, July 2, 1992**

- 10.00    Opening Address  
         Hans-Jürgen Vosgerau (Speaker of the SFB 178)  
         Introduction  
         Bernd Genser (SFB 178)
- 10.30    *Chair: Bernd Genser (SFB 178)*  
         "Intergovernmental Tax Competition"  
         Bruno S. Frey (University of Zürich)
- 11.30    "International Tax Competition and Public Goods Supply:  
         Alternative Views of Government Behaviour"  
         Andreas Haufler (University of Konstanz)
- 12.30-14.00    Lunch (IBZ, University of Konstanz)
- 14.00    *Chair: Gebhard Kirchgässner (University of St.Gallen)*  
         "Explaining the Use of Related Tax Instruments"  
         Stanley L. Winer (Carleton University/Ottawa) and Walter  
         Hettich (California State University/Fullerton)
- 15.00    "Intertemporal Commitment Problems and Voting on  
         Redistributive Taxation"  
         Amihai Glazer (Carnegie Mellon University/Pittsburgh)  
         and Kai A. Konrad (University of München)
- 16.00-16.30    Coffee Break
- 16.30    *Chair: Friedrich Breyer (University of Konstanz)*  
         "The Effects of Tax Administration on Tax Morale"  
         Werner W. Pommerehne (University of Saarbrücken)  
         and Bruno S. Frey (University of Zürich)
- 17.30    "Fuel Taxation in EC Countries: A Political-Economy  
         Approach"  
         Bernd Genser and Hannelore Weck-Hannemann (SFB 178)
- 19.30    Dinner (Schwedenschenke, Insel Mainau)

**Friday, July 3, 1992:**

- 08.30    *Chair: Heinrich Ursprung (SFB 178)*  
         "Fiscal Policy During the Transition in Eastern Europe"  
         Roger H. Gordon (University of Michigan/Ann Arbor)
- 09.30    "Corporate Income Tax Competition, Double Taxation  
         Treaties, and Foreign Direct Investment"  
         Eckhard Janeba (University of Bonn)
- 10.30-11.00    Coffee Break
- 11.00    *Chair: Hannelore Weck-Hannemann (SFB 178)*  
         "The Development of the Shadow Economy under Changing Tax  
         Systems and Structures: Some Theoretical and Empirical  
         Results for Austria"  
         Friedrich Schneider (University of Linz) and Reinhard Neck  
         (University of Bielefeld)
- 12.00    Closing Address  
         Bernd Genser (SFB 178)
- 12.30    End of Workshop
- 13.00    Lunch (Hotel Mainaublick, Egg)

**Organization:** Bernd Genser/Hannelore Weck-Hannemann  
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