

Why enter a tax sparing agreement?

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Abstract

Tax sparing grants a domestic tax credit to a transnational company for taxes which are “spared” by a foreign country. The benefits to the countries involved are not obvious as both incur losses in tax revenue. We investigate the rationale behind tax sparing agreements. With cooperation between countries tax sparing occurs in equilibrium when the bargaining power of the capital-exporting country is low. When countries compete tax sparing is an equilibrium outcome because capital-importing countries engage in tax competition to attract FDI. The capital-importing countries can then be caught in a Prisoner’s dilemma to the benefit of the capital-exporter.

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1 Introduction

The objective of a bilateral tax treaty between a capital-exporting country, or “source” country, and a capital-importing country, or “host” country, is to eliminate or minimize double taxation. A common practice to solve the problem of double taxation is the tax credit method, where the source government allows a resident company to claim a foreign tax credit for taxes paid in the host country. This practice, however, mitigates the incentive effect of any preferential tax treatment, such as a tax holiday or a reduced tax rate, provided by the host country. Moreover, the revenue foregone by the host country is transferred to the treasury of the source country.

For the past five decades capital-importing countries, which are mainly less developed countries (LDCs), have been trying to convince developed countries to include tax sparing provisions in tax treaties. Tax sparing involves the source country providing a tax credit not only on tax which has been paid to the host country but also on tax which has been spared by the host country as a part of a tax incentive scheme. Such a provision strengthens the fiscal incentives provided by the capital-importing country to foreign investors. It is not, however, obvious what benefit tax sparing provides to the capital-exporting country that induces it to enter such an agreement given the revenue loss relative to the position with no tax sparing. Still, tax sparing has been included in many tax treaties and there is evidence that a majority of developed countries grant tax credits on tax that has been spared by host countries.

In this paper we investigate the rationale behind the decisions of host and source countries to agree to a tax sparing provision. To do this we consider two alternative approaches: a *cooperative* approach and a *competitive* approach. In the cooperative approach the terms of a tax treaty are chosen to maximize the payoff in a generalized Nash bargain. In this context, a tax sparing agreement is more likely to emerge in equilibrium when the bargaining power of the capital-exporting country in the negotiations is relatively low. This, however, may not seem a convincing explanation for the case when the capital-importer is a less developed country, whereas the capital-exporter is a developed country. This motivates us to consider the competitive approach, where a tax treaty is the equilibrium of a strategic game between a capital-exporting country and two capital-importing countries that compete for inward investment. A tax sparing agreement can then emerge as an equilibrium outcome when capital-importing countries engage in tax competition to attract foreign investment. Moreover, tax sparing may benefit the capital-exporting country at the cost of the capital-importing countries. This occurs when the capital-importing countries face a Prisoner’s dilemma: for each capital-importing country it is individually-rational to agree to tax sparing, but both capital-importing countries would be better-off if neither agreed. This Prisoner’s dilemma arises because tax sparing intensifies the incentive to engage in tax competition. Tax sparing may therefore be ultimately harmful to the countries that are most in favor of its introduction.

The paper is structured as follows. Section 2 provides some empirical facts

about tax sparing agreements. Section 3 reviews the current literature related to the subject. Section 4 presents a cooperative model of tax treaty negotiations and Section 5 a competitive model. Section 6 concludes. An appendix contains a list of recent tax treaties with a tax sparing provision and the proofs of a number of results.

2 Tax sparing agreements

According to Thuronyi (2003), about one-third of the tax treaties signed between 2000 and 2002 included a tax sparing provision (see the list in Appendix A.1). In many existing bilateral tax treaties with a tax sparing provision the source country is typically a developed country, whereas the host country is a less developed country. At the same time, tax sparing agreements are not uncommon between developed countries; examples are treaties among OECD members and the treaty between the United Kingdom and Switzerland.

In the UK tax sparing was first mentioned in the 1953 report of the British Royal Commission. The Commission's proposal was to grant tax sparing as an aid to British investment abroad. After having been reviewed and debated by Parliament, the proposal was rejected by the Chancellor of the Exchequer in 1957. The debate on tax sparing continued until 1961 when the British government finally passed legislation allowing tax sparing to be given on tax spared by an LDC. The debate in the United States on its position regarding tax sparing started in 1957 with a proposed treaty between the US and Pakistan. This treaty was the first of its kind to contain a tax sparing provision. The proposed tax sparing provision allowed American firms whose income was fully or partly exempted from tax in Pakistan to claim a tax credit in the US as if those incomes were fully taxed in Pakistan. The US Senate insisted on removing this provision from the treaty. Three other proposed tax treaties containing tax sparing provisions were also withdrawn in 1964 (Toaze, 2001). Since then the US has persisted with this position and has never included a tax sparing provision in any of its bilateral tax treaties with other countries (Azémar, 2010).

The terms and conditions of tax sparing vary from one treaty to another. Generally, a provision involves a tax credit on corporate income tax and/or withholding tax on dividend, royalty and interest income. A tax sparing provision often specifies the eligible categories of taxpayers, the eligible source of income, the period of availability of the provision, and the maximum tax rate or the maximum amount of deemed-paid tax eligible for tax sparing credit. Limitations on the period of tax sparing provisions allow treaty countries to re-negotiate the terms and conditions of tax sparing should economic circumstances change. For example, in the tax treaty between Canada and Argentina, signed in 1993, tax sparing was limited to the first five years of the treaty (Toaze, 2001). In some treaties the tax sparing provision is stated in general terms and refers to the overall income tax spared by the host country, without specifying the eligible types of income. Examples are the tax treaty between Canada and China, signed in 1986, and the tax treaty between Spain and India, signed in

1993 (OECD, 1998). Normally, when tax sparing is provided on overall income, the repatriated dividend is exempt of the source country's taxation at home to conserve the host country's tax reduction (OECD, 1998). In some cases, the source country puts a limit on what is eligible for a tax sparing credit. For example, the UK does not allow a tax sparing credit on the export-promotion tax concession offered by an LDC (Collins, 1990, cited in Ashiabor, 1998). In Article 23 of the tax treaty between Canada and Argentina tax sparing does not cover repatriated interest, which is exempt from Argentine's withholding tax (Toaze, 2001).

The agreed tax sparing rate may be capped at a certain ceiling. For example, in the tax treaty between Australia and Vietnam, signed in 1996, the spared tax is not allowed to exceed 20% of the taxable income (OECD, 1998). In other cases, the granted tax sparing credit may be greater than the tax which a residential company has to pay to the host country were the tax incentives not given. An example is the tax treaty between Australia and the Philippines, signed in 1979, according to which the tax sparing credit is greater than the specified treaty rate for certain types of royalty payments (Ashiabor, 1998).

A major concern of both host and source countries regarding tax sparing provisions is that they can be used to avoid taxes and cause losses to both governments. This concern was reflected, in particular, in the 1998 report of the OECD. The following points were emphasized: (1) Tax sparing can facilitate the tax avoidance schemes of multinational companies through transfer pricing. (2) It gives an opportunity to a third-country investor to engage in so-called conduit schemes (a deliberate arrangement of transactions in such a way as to obtain treaty benefits to which they would not otherwise be entitled) in order to minimize global tax liability. (3) When tax sparing allows for withholding tax on interest and royalty to be spared at home, a multinational company can 'route' its gains via companies established in countries that are parties to tax sparing treaties; such schemes are similar to the conduit arrangements but involve treaty shopping in more than two countries. In view of the risk of abuse of tax sparing by both multinational firms and host countries, the OECD recommended its member countries to adopt certain defensive practices. In particular, it was suggested to set a limit on the tax sparing rate, in order to minimize the risk of manipulative and excessive use of tax sparing by the host countries, and to include a time limit (the 'sunset' clause) on tax sparing, in order to prevent it from becoming a permanent tax concession, especially when the economy of an LDC host improves. Furthermore, the OECD recommended its member countries to negotiate tax sparing only with countries whose level of development is below that of OECD members, and to specify clearly the definition of tax incentives and the types of income and business activities covered by the tax sparing clause.

3 Current literature

The main focus of the existing literature on bilateral tax treaties, including tax sparing agreements, is the effect upon the amount of foreign direct investment (FDI) in LDCs made by developed countries. The survey by Davies (2004) shows that the empirical findings diverge widely. Hines (2001) and Azémar *et al.* (2007) found that tax sparing has a positive effect on the location of FDI. Single and Kramer (1996) and Single (1999) found that tax sparing has a minimal effect on FDI, whereas Blonigen and Davies (2002) and Egger *et al.* (2006) found that the effects of tax treaties on FDI can, in fact, be negative.

Hines (2001) demonstrated that tax sparing influences a multinational's choice of location and the willingness of the host government to provide tax incentives. The study compared Japanese and American foreign investment patterns and found that Japanese companies invest 1.4 to 2.4 times more in developing countries that have tax sparing agreements with Japan compared to countries without such agreements, and pay lower tax rates than their American competitors in those countries. The study also presented a theoretical model which suggests that a tax credit provided by the source country induces the host government to apply a reduced tax rate and to substitute tax incentives for non-tax investment incentives. Azémar *et al.* (2007) tested the significance of tax sparing for Japanese outbound direct investment in 26 countries during 1989–2000. They found that tax sparing has a significant positive effect upon the location of Japanese investment. According to their estimates, Japanese FDI flows to tax sparing countries were almost three times larger than flows to non-tax sparing countries, an even larger effect than estimated by Hines (2001).

Single (1999) studied the location decisions of U.S. multinational companies in relation to tax holidays provided by host countries. She found that tax holidays ranked 21st out of the 29 most important factors considered by US companies when choosing foreign investment locations. Moreover, a host country with a tax holiday and a tax sparing agreement is more attractive to a US company even if that company cannot enjoy the tax credit benefits immediately. The conclusion, nonetheless, was that tax sparing is not likely to increase significantly the importance of a host country's tax holiday for US investors, and that a host country would be better off introducing other investment incentives, rather than trying to convince the US to agree to tax sparing.

Blonigen and Davies (2002) tested the FDI flows between OECD countries during 1982–1992 against the bilateral tax treaties signed between them. Their results show that a newly signed treaty does not cause more investment and might, on the contrary, even decrease it. Egger *et al.* (2006) analyzed OECD bilateral outward FDI and tax treaty data during 1985–2000. They found that when the implementation of a tax treaty is endogenously considered, a newly-implemented bilateral treaty negatively affects FDI.

This brief review has described the mixed conclusions reached by the empirical literature regarding the effects of tax treaties. In contrast to the extensive empirical work there is a paucity of theoretical analysis. It appears that the literature can at present offer no explanation of why tax sparing agreements

emerge as a result of negotiations between countries, nor predicts the welfare consequences of the agreements. The models described in the following sections are designed to investigate these questions.

4 Cooperative approach

The cooperative approach analyzes tax sparing as a potential outcome from a process of bargaining between a source country and a host country. The bargain takes place over the surplus derived from the activities of a transnational firm. To reflect the idea of cooperation between the countries we use the generalized Nash bargaining solution to determine the outcome. We allow tax sparing to be a possible equilibrium and characterize the conditions under which it will be part of the bargained outcome.

We denote the source country by X and the host country by Y . A transnational firm from the source country divides its production activity between these two countries. A profit tax is levied in each country. The gross profit earned in country j , π_j , is concave in the output produced in that country, q_j ,

$$\pi_j(q_j) = q_j^\gamma, \quad 0 < \gamma < 1, \quad j = X, Y. \quad (1)$$

To simplify the analysis it is assumed that the total output produced by the firm is fixed at Q . The fractions of output produced in Y and in X are λ and $1 - \lambda$, respectively, so that the profits earned in the two countries are $\pi_Y = (\lambda Q)^\gamma$ and $\pi_X = ((1 - \lambda)Q)^\gamma$. The base profit tax rate in the source country is t_X , and that in the host country is t_Y^* . If the countries enter a tax sparing agreement the host country applies a reduced tax rate, $t_Y < t_Y^*$, and the source country applies a foreign tax credit at the rate $at_Y^* + (1 - a)t_Y$, where a is between zero and one. Accordingly, the firm receives a foreign tax credit in excess of what it paid in tax abroad if a is strictly positive.

The firm chooses the allocation of output between countries, λ , to maximize its total after-tax profit. Given the tax rates and the rate of foreign tax credit the level of after-tax profit, $\bar{\pi}$, can be written

$$\bar{\pi} = (1 - t_X - t_Y + at_Y^* + (1 - a)t_Y)(\lambda Q)^\gamma + (1 - t_X)((1 - \lambda)Q)^\gamma. \quad (2)$$

We focus on the case where the after-tax profit in each country is positive. The profit-maximizing allocation of production between countries is therefore described by

$$\lambda = \frac{\delta}{1 + \delta}, \quad (3)$$

where

$$\delta = \left(1 + a \frac{t_Y^* - t_Y}{1 - t_X}\right)^{1/(1-\gamma)}. \quad (4)$$

The source country and the host country bargain over a and t_Y to maximize the value of the generalized Nash bargain

$$\max_{\{a \in [0,1], t_Y \in [0, t_Y^*]\}} \mathcal{N} = W_X^\mu W_Y^{1-\mu}, \quad (5)$$

where μ and $1 - \mu$ are the bargaining powers of the source country and the host country, respectively. The source country's objective function is total welfare, defined as the sum of tax revenue (TR_X) and the after-tax profit of the firm ($\bar{\pi}$),

$$W_X = TR_X + \bar{\pi}. \quad (6)$$

The level of tax revenue in X is

$$TR_X = (t_X - at_Y^* - (1 - a)t_Y)\pi_Y + t_X\pi_X. \quad (7)$$

Using (2) and (7) gives

$$W_X = (1 - t_Y)(\lambda Q)^\gamma + ((1 - \lambda)Q)^\gamma. \quad (8)$$

The host country's objective function is the level of tax revenues,

$$W_Y = TR_Y = t_Y\pi_Y. \quad (9)$$

The two countries bargain over a and t_y to maximize \mathcal{N} , or equivalently, to maximize

$$\begin{aligned} N &= \ln \mathcal{N} \\ &= \mu \ln [(1 - t_Y)(\lambda Q)^\gamma + ((1 - \lambda)Q)^\gamma] + (1 - \mu) \ln [t_Y(\lambda Q)^\gamma], \end{aligned} \quad (10)$$

where λ is defined by (3) and (4). The outcome of the generalized Nash bargain is summarized in the following proposition (see Appendix A.2 for the proof).

Proposition 1 *For a given base tax rates t_X in the source country and t_Y^* in the host country:*

(i) *If $\mu < 1 - \frac{t_Y^*}{2}$,*

(a) *When $t_Y^* > 2\frac{1-\gamma}{\gamma}(1 - t_X)$ the outcome of bargaining has tax sparing ($t_Y < t_Y^*$) and full foreign tax credit on spared tax ($a = 1$);*

(b) *When $t_Y^* < 2\frac{1-\gamma}{\gamma}(1 - t_X)$ the outcome of bargaining has no tax sparing ($t_Y = t_Y^*$) and the tax credit is given on tax actually paid (a is irrelevant);*

(ii) *If $\mu > 1 - \frac{t_Y^*}{2}$ the outcome of bargaining involves tax sparing, with $t_Y = 2(1 - \mu) < t_Y^*$, but there is no tax credit on spared tax ($a = 0$);*

(iii) *If $\mu = 1 - \frac{t_Y^*}{2}$ the outcome of bargaining has $t_Y = t_Y^*$, so there is no tax sparing (a is irrelevant).*

The important observation of Proposition 1 is that a tax sparing agreement involving a reduced tax rate applied by the host country and a tax credit on spared tax, in excess of the tax actually paid, applied by the source country can emerge as the outcome of bargaining. However, a tax sparing agreement is

not an inevitable outcome since there are cases in which it does not arise. The conditions in case (i.a) show that tax sparing will arise when the bargaining power of the source country is low, the base rates of the two countries are high, and production takes place with close-to-constant returns. A reduced tax rate in the host country can arise with higher bargaining power for the source country (case (ii)), but is not accompanied by a tax credit on spared tax, so does not constitute a tax sparing agreement.

One interpretation of this proposition is that it is in agreement with the observed structure of tax sparing agreements. In particular, the US does not enter into any agreements and this is consistent with the possession of high bargaining power in negotiations. However, tax sparing agreements do exist between countries of very divergent sizes and economic status, so it can be argued that the proposition does not fully explain the existence of tax sparing agreements LDCs and developed countries. In such negotiations it is likely to be the source country that would have the upper hand (formally, a high μ) in bilateral treaty negotiations. This motivates the investigation of an alternative explanation for tax sparing.

5 Competitive approach

The competitive approach assumes that there is one source country and two host countries. The two host countries compete to attract the multinational by offering tax incentives. The source country chooses whether to enter into a tax sparing agreement with either (or both) of the host countries. In this scenario tax sparing has a strategic role: it allows the source country to manipulate the outcome of the tax competition game between the host countries. The analysis demonstrates that this strategic motive can be sufficiently strong that tax sparing does emerge as an equilibrium strategy.

There are three countries: a source country, X , and two host countries, Y and Z . A multinational firm from the source country divides its total production between the host countries. For simplicity we assume away home production. As in the previous model, gross profit in country j is concave in output, $\pi_j(q_j) = q_j^\gamma$, $0 < \gamma < 1$, and the total output is fixed at Q . The fractions of output produced in Y and in Z are λ and $1 - \lambda$, respectively, so that the profits earned in Y and Z are $\pi_Y = (\lambda Q)^\gamma$ and $\pi_Z = ((1 - \lambda)Q)^\gamma$. The firm pays profit tax in each host country and in the source country, with the profit tax rate in the source country denoted by t_X and the base rates in the host countries denoted by t_Y^* and t_Z^* . If host country Y (Z) enters a tax sparing agreement with the source country it applies a reduced tax rate, $t_{Y(Z)}$, to the profits earned by the firm in this host country, and the source country provides a tax credit to its firm at the rate $a_{Y(Z)}t_{Y(Z)}^* + (1 - a_{Y(Z)})t_{Y(Z)}$, with $a_{Y(Z)} \in [0, 1]$.

The competition between the countries is modeled as a three-stage game. In the first stage the source country chooses $\{a_Y, a_Z\} \in [0, 1] \times [0, 1]$ to maximize its welfare, defined as the sum of its tax revenue and the after-tax profit of the firm. In the second stage the host countries simultaneously and non-cooperatively set

tax rates, each aiming to maximize its own tax revenues. The chosen tax can be less than or equal to the base tax rate. In the third stage the firm chooses λ to maximize its total profit, taking as given all decisions in previous stages. The game is solved by backward induction.

The firm maximizes its net of tax profits,

$$\begin{aligned}\bar{\pi} &= (1 - t_X - t_Y + a_Y t_Y^* + (1 - a_Y) t_Y) (\lambda Q)^\gamma \\ &\quad + (1 - t_X - t_Z + a_Z t_Z^* + (1 - a_Z) t_Z) ((1 - \lambda) Q)^\gamma \\ &= Q^\gamma \{ (1 - t_X + a_Y (t_Y^* - t_Y)) \lambda^\gamma \\ &\quad + (1 - t_X + a_Z (t_Z^* - t_Z)) (1 - \lambda)^\gamma \}.\end{aligned}\quad (11)$$

We focus on the case when the after-tax profit in each country is positive, so that:

$$1 - t_X + a_Y (t_Y^* - t_Y) > 0, \quad (12)$$

and

$$1 - t_X + a_Z (t_Z^* - t_Z) > 0. \quad (13)$$

From the first-order condition we obtain the division of output between the two countries

$$\lambda = \frac{\theta}{1 + \theta}, \quad (14)$$

where

$$\begin{aligned}\theta &= \left(\frac{1 - t_X + a_Y (t_Y^* - t_Y)}{1 - t_X + a_Z (t_Z^* - t_Z)} \right)^{1/(1-\gamma)} \\ &\equiv \theta(t_Y, t_Z)\end{aligned}\quad (15)$$

Each host country chooses its tax rate on profit taking into account the behavior of the firm, but taking the tax sparing (if there is any) as given. The analysis focuses on country Y , with the solution for country Z obtained by an interchange of subscripts. Country Y solves

$$\max_{\{0 < t_Y \leq t_Y^*\}} t_Y \pi_Y = t_Y (\lambda Q)^\gamma, \quad (16)$$

or, equivalently,

$$\max_{\{0 < t_Y \leq t_Y^*\}} \ln(t_Y) + \gamma \ln(\lambda) = \ln(t_Y) + \gamma \ln\left(\frac{\theta}{1 + \theta}\right). \quad (17)$$

At an interior solution, the first-order condition can be written as

$$0 = \frac{1}{t_Y} + \frac{\gamma}{1 - \gamma} \frac{1}{1 + \theta} \frac{(-a_Y)}{1 - t_X + a_Y (t_Y^* - t_Y)}. \quad (18)$$

The solution, \bar{t}_Y , to (18) can be defined implicitly by

$$\frac{\frac{1}{1-\gamma} \bar{t}_Y - T_Y}{T_Y - \bar{t}_Y} = \theta(\bar{t}_Y, t_Z), \quad (19)$$

where $T_Y = \frac{1-t_X}{a_Y} + t_Y^*$. Combining this interior solution with the corner solution gives an implicit solution for t_Y

$$t_Y = \min \{ \bar{t}_Y, t_Y^* \} \quad (20)$$

One can show that \bar{t}_Y is an increasing convex function of t_Z (see Appendix A.3) and that an increase in either a_Y or a_Z results in a decrease in \bar{t}_Y for every value of t_Z (see Appendix A.4). This implies that a necessary and sufficient condition for country Y to choose a reduced tax rate (that is, reduced below the base rate t_Y^*) is $\bar{t}_Y < t_Y^*$ at $t_Z = t_Z^*$ and $a_Y = a_Z = 0$, which can be written as

$$t_Y^* > \frac{2-\gamma}{1-\gamma} (1-t_X). \quad (21)$$

Similarly, for host country Z , the choice of tax rate is described implicitly be

$$t_Z = \min \{ \bar{t}_Z, t_Z^* \} \quad (22)$$

where \bar{t}_Z solves

$$\frac{\frac{1}{1-\gamma}\bar{t}_Z - T_Z}{T_Z - \bar{t}_Z} = \frac{1}{\theta(t_Y, \bar{t}_Z)}, \quad (23)$$

with $T_Z = \frac{1-t_X}{a_Z} + t_Z^*$. A sufficient condition for the choice of t_Z below t_Z^* is

$$t_Z^* > \frac{2-\gamma}{1-\gamma} (1-t_X). \quad (24)$$

Expressions (19)–(20) and (22)–(23) implicitly define the reaction functions of each host country, given the tax rate set by the other host country. Because the two reaction functions are strictly increasing and convex in the interior, if an interior equilibrium (with $t_Y < t_Y^*$ and $t_Z < t_Z^*$) exists it is unique and is described implicitly by the set of equations

$$\frac{\frac{1}{1-\gamma}\bar{t}_Y - T_Y}{T_Y - \bar{t}_Y} = \frac{T_Z - \bar{t}_Z}{\frac{1}{1-\gamma}\bar{t}_Z - T_Z}, \quad (25)$$

and

$$\frac{\frac{1}{1-\gamma}\bar{t}_Y - T_Y}{T_Y - \bar{t}_Y} = \theta(\bar{t}_Y, \bar{t}_Z). \quad (26)$$

The optimization problem of the source country, X , is

$$\max_{\{a_Y, a_Z\} \in [0,1] \times [0,1]} W = TR + \bar{\pi}, \quad (27)$$

where

$$TR = (t_X - a_Y t_Y^* + (1 - a_Y) t_Y) \pi_Y + (t_X - a_Z t_Z^* + (1 - a_Z) t_Z) \pi_Z, \quad (28)$$

and $\bar{\pi}$ is given by (11). We assume $t_X > t_{Y(Z)}^*$ to ensure strictly positive tax revenue. Substituting into W and simplifying gives

$$W = Q^\gamma [(1 - t_Y) \lambda^\gamma + (1 - t_Z) (1 - \lambda)^\gamma]. \quad (29)$$

If in the equilibrium $t_{Y(Z)} = t_{Y(Z)}^*$, then W does not depend on $a_{Y(Z)}$, so the choice does not matter. Now consider the case where in equilibrium $t_Y < t_Y^*$. Differentiation of W with respect to a_Y gives

$$\begin{aligned} \frac{1}{Q^\gamma} \frac{dW}{da_Y} &= -\lambda^\gamma \frac{dt_Y}{da_Y} + \gamma(1 - t_Y) \lambda^{\gamma-1} \frac{d\lambda}{da_Y} \\ &\quad - (1 - \lambda)^\gamma \frac{dt_Z}{da_Y} - \gamma(1 - t_Z) (1 - \lambda)^{\gamma-1} \frac{d\lambda}{da_Y}. \end{aligned} \quad (30)$$

Using (14) and (19) we obtain

$$\lambda = \frac{1}{\gamma} - \frac{1 - \gamma}{\gamma} \frac{T_Y}{\bar{t}_Y}, \quad (31)$$

so that

$$\frac{d\lambda}{da_Y} = \frac{1 - \gamma}{\gamma} \left[\frac{1 - t_X}{\bar{t}_Y a_Y^2} + \frac{T_Y}{\bar{t}_Y^2} \frac{d\bar{t}_Y}{da_Y} \right]. \quad (32)$$

Direct substitution into (30) gives

$$\begin{aligned} \frac{1}{\lambda^\gamma Q^\gamma} \frac{dW}{da_Y} &= -\frac{d\bar{t}_Y}{da_Y} - \theta^{-\gamma} \frac{dt_Z}{da_Y} \\ &\quad + \frac{1 - \gamma}{\lambda} (1 - \bar{t}_Y - (1 - t_Z) \theta^{1-\gamma}) \left[\frac{1 - t_X}{\bar{t}_Y a_Y^2} + \frac{T_Y}{\bar{t}_Y^2} \frac{d\bar{t}_Y}{da_Y} \right] \\ &= -\frac{d\bar{t}_Y}{da_Y} - \theta^{-\gamma} \frac{dt_Z}{da_Y} + \frac{\gamma t_Y}{\frac{1}{1-\gamma} \bar{t}_Y - T_Y} (1 - \bar{t}_Y - (1 - t_Z) \theta^{1-\gamma}) \\ &\quad \times \left[\frac{1 - t_X}{\bar{t}_Y a_Y^2} + \frac{T_Y}{\bar{t}_Y^2} \frac{d\bar{t}_Y}{da_Y} \right] \end{aligned} \quad (33)$$

If in the equilibrium $t_Z = t_Z^*$ the second term disappears and $\theta^{1-\gamma}$ simplifies to

$$\theta^{1-\gamma} = 1 + \frac{a_Y (t_Y^* - \bar{t}_Y)}{1 - t_X}. \quad (34)$$

We now analyze these optimization conditions for two separate cases. First, we look in detail at the symmetric case in which the base tax rates of the two host countries are equal. Second, given the results of the symmetric case we briefly consider the asymmetric case.

5.1 Symmetric case

When the two host countries have equal base tax rates ($t_Y^* = t_Z^* = t^*$) and in equilibrium the source country applies an equal degree of tax sparing to the firm's profits earned in the two countries (so $a_Y = a_Z = a$) a closed form solution obtains for the equilibrium.

From (19) and (23) it follows that this equilibrium is symmetric since

$$\theta = 1, \lambda = \frac{1}{2}, \quad (35)$$

and

$$\bar{t}_Y = \bar{t}_Z = \bar{t}^S = \frac{1}{1 + \frac{\gamma}{2(1-\gamma)}} \frac{1 - t_X + at^*}{a}. \quad (36)$$

From (36) it can be seen that the equilibrium is in the interior if

$$t^* > 2 \frac{1-\gamma}{\gamma} \frac{1-t_X}{a}, \quad (37)$$

and it is in the corner otherwise.

Furthermore, (33) simplifies to

$$\frac{1}{(\lambda Q)^\gamma} \frac{dW}{da_Y} \Big|_{a_Y=a_Z=a} = - \left(\frac{dt_Y}{da_Y} + \frac{dt_Z}{da_Y} \right)_{a_Y=a_Z=a} > 0 \quad (38)$$

since, as shown in Appendix A.4, both $\frac{dt_Y}{da_Y}$ and $\frac{dt_Z}{da_Y}$ are negative. Therefore, it is optimal for the source country to set $a = 1$. Such an equilibrium exists if

$$t^* > 2 \frac{1-\gamma}{\gamma} (1-t_X), \quad (39)$$

and the equilibrium tax rates are

$$t_Y = t_Z = \frac{2(1-\gamma)}{2-\gamma} (1-t_X + t^*). \quad (40)$$

For a symmetric corner equilibrium

$$t_Y = t_Z = t^*, \quad \theta = 1, \lambda = \frac{1}{2}, \quad (41)$$

and the welfare function does not depend on a . The kink in the welfare function occurs at the point

$$a = 2 \frac{1-\gamma}{\gamma} \frac{1-t_X}{t^*}. \quad (42)$$

These results are summarized in Proposition 2.

Proposition 2 *In the symmetric case ($t_Y^* = t_Z^* = t^*$)*

(i) *If t^* and t_X satisfy $t^* > 2\frac{1-\gamma}{\gamma}(1-t_X)$ there exists an interior equilibrium (tax sparing agreement) with reduced host tax rates*

$$t_Y = t_Z = \frac{2(1-\gamma)}{2-\gamma}(1-t_X+t^*) < t^*$$

and full foreign tax credit on spared tax at home ($a = 1$).

(ii) *Otherwise there exists a symmetric corner equilibrium without tax sparing ($t_Y = t_Z = t^*$) and with the tax credit on tax actually paid.*

The key condition in (i) of the proposition requires that the base tax rate of the host country is sufficiently high. This is a natural requirement: tax sparing is driven by the process of tax competition between host countries so this effect will be strongest when starting from a high level with scope for significant reductions in the equilibrium tax rates. The condition is also more likely to hold when γ is large since this reduces the incentive of the firm to equally divide production which makes the tax base more mobile and, hence, intensifies the tax competition.

The cases of interior and corner equilibria are illustrated in Figures 1 and ?? . In the first case the Nash equilibrium is in the interior: both countries apply the same reduced tax rate, or, in other words, enter the tax sparing agreement with the source country. In the second case the Nash equilibrium is in the corner: both countries apply their base tax rates, i.e. do not enter the agreement. There is no asymmetric equilibria: it is never optimal for one country to enter if the other stays out, and vice versa. The asymmetric equilibria may occur if the base tax rates are different in two countries or the host countries are treated differently by the source country.

The following two numerical examples illustrate the interior equilibrium and show why an equilibrium with only one country entering a tax sparing agreement cannot be an equilibrium.

Example 1. For $t_X = 0.6, t_{Y,Z}^* = 0.5, \gamma = 0.9, Q = 2$ direct calculation gives:

- If each host countries enters (denoted E in the payoff matrix) a tax sparing agreement then $t_Y = t_Z = 0.164$, and $\lambda = 1/2$;
- If Y enters an agreement and Z does not (denoted N in the payoff matrix), $t_Z = t_Z^* = 0.5, t_Y = 0.416$, and $\lambda = 0.871$;
- The situation is symmetric for Z .

The source country's welfare level is equal to 1.67 when it has agreements with Y , and Z , 1.11 when the agreement is only with one country, Y or Z , and 1 without agreement with either of Y or Z . The competition between the two host countries is of the Prisoner's Dilemma type: choosing E is the dominant strategy for each, whereas both would be better off choosing N . The agreement ultimately benefits the source country at the cost of the host countries.

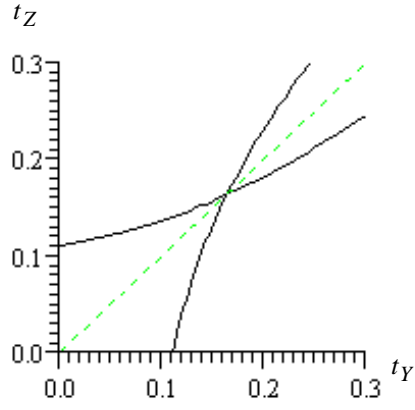


Figure 1: Equilibrium with tax sparing: $a = 1, \gamma = 0.9, t_Y^* = t_Z^* = 0.4, t_X = 0.3$.

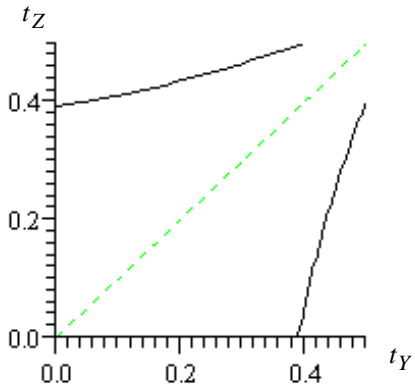


Figure 2: Equilibrium without tax sparing: $a = 0.15, \gamma = 0.9, t_Y^* = t_Z^* = 0.3, t_X = 0.4$.

		<i>Z</i>	
		<i>E</i>	<i>N</i>
<i>Y</i>	<i>E</i>	0.164	0.148
	<i>N</i>	0.164	0.685
	<i>N</i>	0.685	0.500
		0.148	0.500

Figure 3: Payoff matrix (tax revenues)

		<i>Z</i>	
		<i>E</i>	<i>N</i>
<i>Y</i>	<i>E</i>	0.164	0.187
	<i>N</i>	0.164	0.334
	<i>N</i>	0.334	0.300
		0.187	0.300

Figure 4: Payoff matrix (tax revenues)

Example 2. For $t_X = 0.4$, $t_{Y,Z}^* = 0.3$, $\gamma = 0.9$, $Q = 2$ direct calculation gives:

- If each host countries enters tax a sparing agreement then $t_Y = t_Z = 0.164$, and $\lambda = 1/2$;
- If Y enters an agreement and Z does not, $t_Z = t_Z^* = 0.3$, $t_Y = 0.246$, and $\lambda = 0.704$;
- The situation is symmetric for Z .

The source country's welfare is equal to 1.67 when it has agreements with Y and Z , 1.46 when the agreement is only with one country, Y or Z , and 1.4 without agreement with either of Y or Z . The competition between the two host countries has two pure-strategy Nash equilibria, in which one country enters an agreement and the other one does not; there is also a mixed-strategy Nash equilibrium where each host country enters an agreement with probability ≈ 0.6 . The agreement again benefits the source country at the cost of the

host countries: not-entering Pareto-dominates the Nash equilibria for the host countries.

The conclusions above have been derived on the basis that $a_Y = a_Z = a$, so we now need to check that it is not beneficial for the source country to treat the two host countries differently. Suppose, country X announces $a_Y = 1$ and $a_Z = 0$. The optimal choice of the firm is

$$\lambda = \frac{\tilde{\theta}}{\tilde{\theta} + 1}, \quad (43)$$

where

$$\tilde{\theta} = \left(\frac{1 - t_X - t_Y + t^*}{1 - t_X} \right)^{1/(1-\gamma)}. \quad (44)$$

The optimal choice of country Y is

$$t_Y^A = \min \left\{ \frac{1 - t_X + t^*}{1 + \frac{\gamma}{1-\gamma} \frac{1}{1+\tilde{\theta}}}, t^* \right\}, \quad (45)$$

and the optimal choice of country Z is

$$t_Z = t^*, \quad (46)$$

since the firm's pre-tax profit in country Z does not depend on the tax rate it faces in Z .

If the values of t^* , t_X and γ are such that $t_Y = t^*$ (corner solution) the equilibrium is symmetric. It therefore remains to analyze the case with an interior solution for t_Y . The source country's welfare is then

$$W^A = \left(1 - \frac{1 - t_X + t^*}{1 + \frac{\gamma}{1-\gamma} \frac{1}{1+\tilde{\theta}}} \right) \left(\frac{\tilde{\theta}}{\tilde{\theta} + 1} \right)^\gamma + (1 - t^*) \left(\frac{1}{\tilde{\theta} + 1} \right)^\gamma. \quad (47)$$

We now show that when the two host countries are treated identically the welfare of the source country is higher, given the same value of t^* , t_X and γ . Note, first, that $\tilde{\theta} > 1$ and, hence,

$$t_Y^A = \frac{1 - t_X + t^*}{1 + \frac{\gamma}{1-\gamma} \frac{1}{1+\tilde{\theta}}} > \frac{1 - t_X + t^*}{1 + \frac{\gamma}{1-\gamma} \frac{1}{2}} = t^S, \quad (48)$$

i.e. in the absence of tax competition country Y sets the reduced tax rate higher than in the presence of tax competition. This implies that if the values of the parameters are such that the optimal tax in the asymmetric case is in the interior, in the symmetric case the solution is also in the interior:

$$t^* > \frac{1 - t_X + t^*}{1 + \frac{\gamma}{1-\gamma} \frac{1}{1+\tilde{\theta}}} > \frac{1 - t_X + t^*}{1 + \frac{\gamma}{1-\gamma} \frac{1}{2}} \quad (49)$$

We showed in the previous section that in such a case it is optimal for the source country to set $a = 1$. Hence, we need to compare (47) and the welfare with symmetric treatment,

$$W^S = 2(1 - t^S) \left(\frac{1}{2}\right)^\gamma. \quad (50)$$

For the tax sparing agreement to exist the baseline tax rate in the host country has to be high enough. From (45) one can derive the cut-off level of t^* , by setting $\frac{1 - t_X + t^*}{1 + \frac{\gamma}{1-\gamma} \frac{1}{1+\tilde{\theta}}} = t^*$ and $\tilde{\theta} = 1$, respectively:

$$\hat{t}^* = \frac{2 - \gamma}{1 - \gamma} (1 - t_X). \quad (51)$$

Let us fix γ and t_X and consider W^A and W^S as functions of t^* . It is easy to see that at $t^* = \hat{t}^*$ the two welfare levels are equal: the “favoured” host country optimally chooses no reduction in the tax rate, $t_Y^A = t^*$, and, as a result, the situation is symmetric, i.e. both host countries apply the same, baseline tax rate. The “favoured” host country will only have incentives to reduce its tax rate if $t^* > \hat{t}^*$. Observe that W^S is a decreasing linear function of t^* :

$$W^S = 2^{1-\gamma} \left(1 - \frac{1 - t_X + t^*}{1 + \frac{\gamma}{1-\gamma} \frac{1}{2}}\right), \quad (52)$$

so

$$\frac{dW^S}{dt^*} = -2^{1-\gamma} \frac{1}{1 + \frac{\gamma}{1-\gamma} \frac{1}{2}}. \quad (53)$$

In Appendix A.5 we demonstrate that W^A is also a decreasing function of t^* , and $\left|\frac{dW^A}{dt^*}\right| > \frac{dW^S}{dt^*}$, at least for $t^* = \hat{t}^*$. This implies $W^A < W^S$ at least for $t^* \in [\hat{t}^*, \hat{t}^* + \varepsilon]$ for small ε , and for any given γ and t_X . This confirms that, at least locally, symmetric treatment of the two host countries is optimal. Numerical calculations show that for the examples considered the inequality $W^A < W^S$ holds for $t^* \in [\hat{t}^*, t_X]$ for any given γ and t_X in the admissible set of parameters.

5.2 Asymmetric case

The reasoning used above allows the outcome in the asymmetric case where the base tax rates differ ($t_Y^* \neq t_Z^*$) to be easily understood. Tax sparing occurs in the symmetric case because it causes the tax rates set by the host countries to be reduced. That is, the reactions functions depicted in Figures 1 and ?? are shifted inwards. This causes any interior intersection to shift downwards, and can cause a corner equilibrium to become interior.

This same mechanism is at work in the asymmetric case. In Appendix A.4 it is shown that the reaction function of each host country shifts inwards in response to an increase in either a_Y or a_Z . Expressed formally,

$$\frac{\partial \bar{t}_i}{\partial a_j} < 0 \text{ for } i, j = Y, Z. \quad (54)$$

In other words, when the source country increases the degree of tax sparing granted to the firm on the profits earned in one host country, this induces each host country to reduce its tax rates for every value of tax rate set by its competitor. As a result, the new equilibrium tax rates will be lower. As in the symmetric case, for some parameter values this effect can be sufficient to ensure that tax sparing can arise in equilibrium.

6 Conclusion

Tax sparing agreements are a common solution to the problem of double taxation and are designed to enhance the fiscal incentive offered by capital-importing countries. We presented two alternative explanations for why countries may enter such agreements despite the apparent loss of tax revenue.

In the *cooperative* framework the source country and the host country bargain over the profit tax rate and the foreign tax credit rate to be applied to the multinational firm. We show that the outcome with tax sparing agreement is more likely to occur when source country's bargaining power is relatively low. This may not seem a satisfactory explanation for the agreements where the host is a less developed country and the source is a developed country.

In an alternative, *competitive* framework, two host countries compete with each other in attracting the foreign investor. The reduced tax rates in this case are the outcome of tax competition. This allows the source country, in turn, to implement a foreign tax credit in excess of what the firm has actually paid in foreign tax. The tax sparing unambiguously benefits the source country, whereas the two host countries may find themselves locked in a Prisoner's Dilemma situation: entering a tax sparing agreement with the capital-exporter is a dominant strategy, whereas both host countries would be better off if both remained outside the agreement. This result supports the opinion that tax sparing agreements are damaging for the capital-importing countries, at least in terms of the tax revenues.

One must note, however, that FDI is a far more complex issue that involves, in particular, creation of employment and infrastructure, and various other spillover and externalities, both positive and negative, in the host countries, and whether or not a less developed country should forgo some of its tax revenues in order to attract foreign investors requires research of a much larger scope.

A Appendix

A.1 A list of treaties with tax sparing provision signed between 2000 and 2002.

Treaties with tax sparing provision	Date of signature
Albania-Malta	02/May/2000
Armenia-Qatar	22/Apr/2002
Australia-Malaysia	28/July/2002
Austria- Nepal	15/Dec/2000
Bahrain-Thailand	03/Nov/2001
Barbados-Malta	05/Dec/2001
Brazil-Paraguay	20/Sept/2000
Bulgaria-Mongolia	28/Feb/2000
Bulgaria-Thailand	16/June/2000
Canada-Mongolia	27/May/2002
China-Nepal	14/Mar/2001
Cuba-Russia	14/Dec/2000
Cyprus-Mauritius	21/Jan/2000
Denmark-Pakistan	02/May/2002
Estonia-Malta	03/May/2001
Germany-Malta	08/Mar/2001
Greece-Slovenia	05/June/2001
Greece-Ukraine	06/Nov/2000
Iceland-Vietnam	03/Apr/2002
Ireland-India	06/Nov/2000
Korea-Algeria	24/Nov/2001
Korea-Nepal	05/Oct/2001
Korea-Slovak Republic	27/Aug/2001
Latvia-Malta	22/May/2000
Lithuania-Malta	17/May/2001
Malta-Russia	15/Dec/2000
Malta-Tunisia	31/May/2000
Netherlands-Mongolia	08/Mar/2002
Nepal-Pakistan	25/Jan/2001
Portugal-Cuba	30/Oct/2000
Portugal-Malta	26/Jan/2001
Spain-Turkey	05/July/2002
Thailand-United Arab Emirates	01/Mar/2000
Source: Thuronyi (2003, p. 302)	

A.2 Proof of Proposition 1.

The partial derivatives of the objective function with respect to a and t_Y are denoted $N_a = \frac{\partial N}{\partial \lambda} \frac{\partial \lambda}{\partial a}$, and $N_{t_Y} = \frac{\partial N}{\partial \lambda} \frac{\partial \lambda}{\partial t_Y} + \frac{\partial N}{\partial t_Y}$. Direct computation gives

$$\frac{\partial N}{\partial \lambda} = \frac{\gamma}{\lambda} \left[1 - \mu \frac{1 + \delta}{1 + (1 - t_Y) \delta^\gamma} \right], \quad (55)$$

and

$$\frac{\partial N}{\partial t_Y} = \frac{1}{t_Y} \left[1 - \mu \frac{1 + \delta^\gamma}{1 + (1 - t_Y) \delta^\gamma} \right]. \quad (56)$$

Observe that

$$\frac{\partial \lambda}{\partial a} = \frac{1}{(1+\delta)^2} \frac{\delta^\gamma}{1-\gamma} \frac{t_Y^* - t_Y}{1-t_X} \begin{cases} > 0 & \text{for } t_Y < t_Y^*, \\ = 0 & \text{for } t_Y = t_Y^*, \end{cases} \quad (57)$$

and

$$\frac{\partial \lambda}{\partial t_Y} = -\frac{a}{t_Y^* - t_Y} \frac{\partial \lambda}{\partial a}. \quad (58)$$

First we show that in equilibrium both a and t_Y cannot be in the interior. Assume, on the contrary, that $N_a = 0$ for some $a \in (0, 1)$ and some $t_Y \in (0, t_Y^*)$.

This requires $\frac{\partial N}{\partial \lambda} = 0$ since in this case $\frac{\partial \lambda}{\partial a} > 0$. Then

$$\mu = \frac{1 + (1 - t_Y) \delta^\gamma}{1 + \delta}$$

and

$$\begin{aligned} N_{t_Y} &= \frac{\partial N}{\partial t_Y} = \frac{1}{t_Y} \left[1 - \mu \frac{1 + \delta^\gamma}{1 + (1 - t_Y) \delta^\gamma} \right] \\ &= \frac{1}{t_Y} \left[1 - \frac{1 + \delta^\gamma}{1 + \delta} \right] > 0 \end{aligned}$$

since $\delta \geq 1$ and $\gamma \in (0, 1)$. Therefore, in equilibrium $t_Y = t_Y^*$ which contradicts our assumption. We conclude that if there is an equilibrium with $a \in (0, 1)$ it necessarily has $t_Y = t_Y^*$. However, if the latter holds the value of the objective function does not depend on a , and, therefore, if in equilibrium $t_Y = t_Y^*$ there is a continuum of such equilibria with $a \in [0, 1]$.

Now consider the possibility of an equilibrium with $a = 0$ and $t_Y \in (0, t_Y^*)$. This requires $N_a \leq 0$ at $a = 0$, or

$$\left. \frac{\partial N}{\partial \lambda} \right|_{a=0} = \frac{\gamma}{\lambda} \left[1 - \mu \frac{1 + \delta}{1 + (1 - t_Y) \delta^\gamma} \right]_{a=0} = \frac{\gamma}{\lambda} \left[1 - \frac{\mu}{1 - \frac{t_Y}{2}} \right] \leq 0,$$

since if $a = 0$ then $\delta = 1$. Thus, for N_{t_Y} we have

$$\begin{aligned} N_{t_Y}|_{a=0} &= \left. \frac{\partial N}{\partial t_Y} \right|_{a=0} = \frac{1}{t_Y} \left[1 - \mu \frac{1 + \delta^\gamma}{1 + (1 - t_Y) \delta^\gamma} \right]_{a=0} \\ &= \frac{1}{t_Y} \left[1 - \frac{\mu}{1 - \frac{t_Y}{2}} \right] \leq 0. \end{aligned}$$

Therefore, in the equilibrium $a = 0$ and $t_Y = 2(1 - \mu) < t_Y^*$ provided that $\mu > 1 - \frac{t_Y^*}{2}$. Condition $\mu < 1 - \frac{t_Y^*}{2}$ can only be consistent with an equilibrium where $a = 1$.

Finally, consider the possibility of an equilibrium with $a = 1$ and $t_Y \in (0, t_Y^*)$. This requires $N_a \geq 0$ at $a = 1$, or

$$\left. \frac{\partial N}{\partial \lambda} \right|_{a=1} = \frac{\gamma}{\lambda} \left[1 - \mu \frac{1 + \delta}{1 + (1 - t_Y) \delta^\gamma} \right]_{a=1} \geq 0$$

and, therefore,

$$\mu \leq \left. \frac{1 + (1 - t_Y) \delta^\gamma}{1 + \delta} \right|_{a=1} \quad (59)$$

For N_{t_Y} we have

$$\begin{aligned} N_{t_Y} &= -\frac{1}{(1 + \delta)^2} \frac{\delta^\gamma}{1 - \gamma} \frac{a}{1 - t_X} \frac{\gamma}{\lambda} \left[1 - \mu \frac{1 + \delta}{1 + (1 - t_Y) \delta^\gamma} \right] \\ &\quad + \frac{1}{t_Y} \left[1 - \mu \frac{1 + \delta^\gamma}{1 + (1 - t_Y) \delta^\gamma} \right]. \end{aligned}$$

For the solution to be in the interior it must be the case that $N_{t_Y} > 0$ at $t_Y \searrow 0$ and $N_{t_Y} < 0$ at $t_Y \nearrow t_Y^*$. If $t_Y = 0$ then

$$\delta = \left(1 + \frac{t_Y^*}{1 - t_X} \right)^{\frac{1}{1 - \gamma}} = \widehat{\delta}$$

and

$$\lim_{t_Y \searrow 0} N_{t_Y} = +\infty.$$

If $t_Y = t_Y^*$ then $\delta = 1$, so that $\lambda = \frac{1}{2}$. Thus,

$$\begin{aligned} \lim_{t_Y \nearrow t_Y^*} N_{t_Y} &= -\frac{1}{4} \frac{\gamma}{1 - \gamma} \frac{2}{1 - t_X} \left[1 - \mu \frac{2}{2 - t_Y^*} \right] \\ &\quad + \frac{1}{t_Y^*} \left[1 - \mu \frac{2}{2 - t_Y^*} \right] \\ &= \left[1 - \mu \frac{2}{2 - t_Y^*} \right] \left[-\frac{1}{4} \frac{\gamma}{1 - \gamma} \frac{2}{1 - t_X} + \frac{1}{t_Y^*} \right] \end{aligned}$$

The first term is positive since (59) implies that at $a = 1$ and as $t_Y \rightarrow t_Y^*$,

$$\mu \leq 1 - \frac{t_Y^*}{2}.$$

Hence, $N_{t_Y} < 0$ at $t_Y \nearrow t_Y^*$ if and only if the second term is negative, i.e.

$$-\frac{1}{4} \frac{\gamma}{1 - \gamma} \frac{2}{1 - t_X} + \frac{1}{t_Y^*} < 0$$

or

$$t_Y^* > 2 \frac{1 - \gamma}{\gamma} (1 - t_X).$$

Otherwise, $N_{t_Y} \geq 0$ at $t_Y \nearrow t_Y^*$ and in equilibrium $t_Y = t_Y^*$. To summarize,

$$\begin{aligned} 0 \leq \mu < 1 - \frac{t_Y^*}{2} &\Rightarrow a = 0, & t_Y &= 2(1 - \mu), \\ 1 - \frac{t_Y^*}{2} \leq \mu \leq 1 &\Rightarrow a = 1, & \begin{cases} t_Y < t_Y^* & \text{if } t_Y^* > 2\frac{1-\gamma}{\gamma}(1 - t_X), \\ t_Y = t_Y^* & \text{if } t_Y^* \leq 2\frac{1-\gamma}{\gamma}(1 - t_X). \end{cases} \end{aligned}$$

A.3 Proof of Proposition 2

Here we prove that in the competitive framework the reaction functions of the two host countries are increasing and convex in the interior.

Using the notation $T_{Y(Z)} = \frac{1 - t_X}{a_{Y(Z)}} + t_{Y(Z)}^*$ we rewrite (19) as

$$\frac{T_Y - t_Y}{T_Z - t_Z} = \left[\frac{\frac{1}{1-\gamma}t_Y - T_Y}{T_Y - t_Y} \right]^{1-\gamma}$$

This can be rearranged as

$$t_Z = T_Z - (T_Y - t_Y)^{2-\gamma} \left(\frac{1}{1-\gamma}t_Y - T_Y \right)^{-1+\gamma}.$$

Differentiation with respect to t_Y gives

$$\begin{aligned} \frac{dt_Z}{dt_Y} &= (2-\gamma)(T_Y - t_Y)^{1-\gamma} \left(\frac{1}{1-\gamma}t_Y - T_Y \right)^{-1+\gamma} \\ &\quad + (1-\gamma)(T_Y - t_Y)^{2-\gamma} \left(\frac{1}{1-\gamma}t_Y - T_Y \right)^{-2+\gamma} \frac{1}{1-\gamma} \\ &= (T_Y - t_Y)^{1-\gamma} \left(\frac{1}{1-\gamma}t_Y - T_Y \right)^{-2+\gamma} \\ &\quad \times \left[(2-\gamma) \left(\frac{1}{1-\gamma}t_Y - T_Y \right) + T_Y - t_Y \right] \\ &= (T_Y - t_Y)^{1-\gamma} \left(\frac{1}{1-\gamma}t_Y - T_Y \right)^{-2+\gamma} \left[\frac{1}{1-\gamma}t_Y - (1-\gamma)T_Y \right] \\ &= (T_Y - t_Y)^{1-\gamma} \left(\frac{1}{1-\gamma}t_Y - T_Y \right)^{-1+\gamma} \\ &\quad + \gamma T_Y (T_Y - t_Y)^{1-\gamma} \left(\frac{1}{1-\gamma}t_Y - T_Y \right)^{-2+\gamma}. \end{aligned}$$

Clearly, this is positive, and we can invert it to obtain

$$\frac{dt_Y}{dt_Z} = \left(\frac{dt_Z}{dt_Y} \right)^{-1}.$$

Hence we showed that the reaction function of country Y is upward-sloping in the interior,

$$\frac{dt_Y}{dt_Z} \begin{cases} \gg 0, & 0 < t_Z < \min\{\bar{t}_Z, t_Z^*\} \\ = 0, & \min\{\bar{t}_Z, t_Z^*\} < t_Z < t_Z^* \end{cases}$$

where \bar{t}_Z solves

$$\begin{aligned} t_Y^* &= \frac{1}{1 + \frac{\gamma}{1-\gamma} \frac{1}{1+\bar{\theta}}} \left(t_Y^* + \frac{1-t_X}{a} \right), \\ \bar{\theta} &= \left(\frac{1-t_X}{1-t_X + a(t_Z^* - t_Z)} \right)^{1/(1-\gamma)}. \end{aligned}$$

Further, the reaction function of country Y is strictly convex in the interior. One can see immediately from the expression for $\frac{dt_Z}{dt_Y}$ that it is decreasing in t_Y , i.e. $\frac{d^2 t_Z}{dt_Y^2} \ll 0$ in the interior, and therefore $\frac{d^2 t_Y}{dt_Z^2} \gg 0$ in the interior. The exact expression for the second derivative is

$$\frac{d^2 t_Z}{dt_Y^2} = -\frac{2-\gamma}{1-\gamma} (\gamma T_Y)^2 (T_Y - t_Y)^{-\gamma} \left(\frac{1}{1-\gamma} t_Y - T_Y \right)^{-3+\gamma}.$$

The analysis of the reaction function of country Z is similar.

A.4 Analysis of reaction functions

Here we prove that

$$\frac{\partial \bar{t}_Y}{\partial a_Y} < 0, \quad \frac{\partial \bar{t}_Y}{\partial a_Z} \forall t_Z \in [0, t_Z^*]$$

(the proof for \bar{t}_Z is similar).

In the interior,

$$(1-\gamma)T_Y < t_Y < t_Y^*, \quad (60)$$

the reaction function $t_Y(t_Z)$ of country Y is described implicitly by (19). Log-differentiating both sides of (19) and collecting the terms gives

$$\begin{aligned} & dt_Y \left[\frac{\frac{1}{1-\gamma}}{\frac{1}{1-\gamma}t_Y - T_Y} + \frac{1 + \frac{1}{1-\gamma}}{T_Y - t_Y} \right] \\ &= \frac{da_Y}{a_Y} \frac{1}{1-\gamma} \left[1 - \frac{1-t_X}{a_Y} \left(\frac{2-\gamma}{T_Y - t_Y} + \frac{1-\gamma}{\frac{1}{1-\gamma}t_Y - T_Y} \right) \right] \\ &\quad - \frac{da_Z}{a_Z} \frac{1}{1-\gamma} \left[1 - \frac{1-t_X}{a_Z} \frac{1}{T_Z - t_Z} \right] \end{aligned}$$

and, after simplification,

$$\begin{aligned} & dt_Y \frac{\frac{1}{1-\gamma}t_Y - (1-\gamma)T_Y}{\left(\frac{1}{1-\gamma}t_Y - T_Y\right)(T_Y - t_Y)} \\ = & \frac{da_Y (t_Y^* - t_Y) \left(\frac{1}{1-\gamma}t_Y - T_Y\right) - \gamma \frac{1-t_X}{a_Y} t_Y}{a_Y \left(\frac{1}{1-\gamma}t_Y - T_Y\right)(T_Y - t_Y)} \\ & - \frac{da_Z \frac{t_Z^* - t_Z}{T_Z - t_Z}}{a_Z \frac{t_Z^* - t_Z}{T_Z - t_Z}}. \end{aligned}$$

The coefficient on dt_Y is positive by (60). Hence,

$$\frac{\partial t_Y}{\partial a_Z} = -\frac{1}{a_Z} \frac{t_Z^* - t_Z}{T_Z - t_Z} \frac{\left(\frac{1}{1-\gamma}t_Y - T_Y\right)(T_Y - t_Y)}{\frac{1}{1-\gamma}t_Y - (1-\gamma)T_Y} < 0 \text{ for } t_Z < t_Z^*.$$

Further,

$$\frac{\partial t_Y}{\partial a_Y} = \frac{1}{a_Y} \frac{(t_Y^* - t_Y) \left(\frac{1}{1-\gamma}t_Y - T_Y\right) - \gamma \frac{1-t_X}{a_Y} t_Y}{\frac{1}{1-\gamma}t_Y - (1-\gamma)T_Y}.$$

For the numerator, using again (60), we have

$$\begin{aligned} & (t_Y^* - t_Y) \left(\frac{1}{1-\gamma}t_Y - T_Y\right) - \gamma \frac{1-t_X}{a_Y} t_Y \\ < & (t_Y^* - t_Y) \left(\frac{1}{1-\gamma}t_Y - T_Y\right) - \gamma(1-\gamma) \frac{1-t_X}{a_Y} T_Y \\ = & (t_Y^* - t_Y) \left(\frac{1}{1-\gamma}t_Y - \frac{1-t_X}{a_Y} - t_Y^*\right) - \gamma(1-\gamma) \frac{1-t_X}{a_Y} \left(\frac{1-t_X}{a_Y} + t_Y^*\right) \\ = & -\gamma(1-\gamma) \left(\frac{1-t_X}{a_Y}\right)^2 - [(1+\gamma(1-\gamma))t_Y^* - t_Y] \frac{1-t_X}{a_Y} - \left(\frac{1}{1-\gamma}t_Y - t_Y^*\right)(t_Y^* - t_Y) < 0 \end{aligned}$$

since each term is negative.

Hence,

$$\frac{\partial t_Y}{\partial a_Y} < 0.$$

A.5 Analysis of asymmetric treatment of identical host countries

First, we show that $\frac{dW^A}{dt^*} < 0$. Direct calculation gives

$$\begin{aligned}
\frac{dW^A}{dt^*} &= -\frac{1}{(1+\tilde{\theta})^\gamma} \left(1 + \tilde{\theta} \frac{dt_Y^A}{dt^*}\right) \\
&\quad - \frac{\gamma}{(1+\tilde{\theta})^{\gamma+1}} \left[(1-t^*) - (1-t_Y^A)\tilde{\theta}^{\gamma-1}\right] \frac{d\tilde{\theta}}{dt^*} \\
&= -\frac{1}{(1+\tilde{\theta})^\gamma} \left(1 + \tilde{\theta} \frac{dt_Y^A}{dt^*}\right) \\
&\quad - \frac{\gamma}{(1+\tilde{\theta})^{\gamma+1}} \frac{(t^* - t_Y^A)(t_X - t^*)}{1 - t_X - t_Y^A + t^*} \frac{d\tilde{\theta}}{dt^*}.
\end{aligned} \tag{61}$$

To calculate $\frac{dt_Y^A}{dt^*}$ and $\frac{d\tilde{\theta}}{dt^*}$ we take total differentials of the two equations that implicitly define t_Y^A and $\tilde{\theta}$,

$$\begin{aligned}
d\tilde{\theta} &= d \left[\left(\frac{1 - t_X - t_Y^A + t^*}{1 - t_X} \right)^{1/(1-\gamma)} \right], \\
dt_Y^A &= d \left[\frac{1 - t_X + t^*}{1 + \frac{\gamma}{1-\gamma} \frac{1}{1+\tilde{\theta}}} \right],
\end{aligned}$$

and solve these for $d\tilde{\theta}$ and dt_Y^A in terms of dt^* :

$$\begin{aligned}
d\tilde{\theta} &= \Delta^{-1} \frac{dt^*}{(1-\gamma)t_Y^A(1-t_X+t^*)}, \\
dt_Y^A &= \Delta^{-1} \frac{1 + (1-\gamma)(1+\tilde{\theta})/\tilde{\theta}}{(1-\gamma)(1+\tilde{\theta})(1-t_X+t^*)} dt^*,
\end{aligned}$$

where

$$\Delta = \frac{1}{\tilde{\theta}t_Y^A} + \frac{1}{(1-\gamma)(1+\tilde{\theta})(1-t_X+t^*)} \frac{\gamma}{\gamma + (1-\gamma)(1+\tilde{\theta})}.$$

Clearly, $\frac{dt_Y^A}{dt^*}$ and $\frac{d\tilde{\theta}}{dt^*}$ are positive, and, therefore, $\frac{dW^A}{dt^*}$ is negative (note that in our model it is assumed that $t_X > t^*$, otherwise foreign tax credit would not apply).

Now it is easy to see that $\left| \frac{dW^A}{dt^*} \right| > \left| \frac{dW^S}{dt^*} \right|$ at $t^* = \hat{t}^*$. Indeed, at this point $t^* - t_Y^A = 0$ and $\tilde{\theta} = 1$, so the second term in (61) disappears, and for the rest, upon simplification, we obtain

$$\begin{aligned} \left. \frac{dW^A}{dt^*} \right|_{\hat{t}^*} &= -\frac{1}{2\gamma} \left(1 + \left. \frac{dt_Y^A}{dt^*} \right|_{\hat{t}^*} \right) \\ &= -\frac{1}{2\gamma} \left(1 + \left[1 + \frac{1+\gamma}{2(1-\gamma)} \right] \left[1 + \frac{1}{2(1-\gamma)} \right] \right). \end{aligned}$$

Therefore,

$$\begin{aligned} &\left| \left. \frac{dW^A}{dt^*} \right|_{\hat{t}^*} - \left| \frac{dW^S}{dt^*} \right| \right| \\ &= \frac{1}{2\gamma} \left(1 + \left[1 + \frac{1+\gamma}{2} \right] \left[1 + \frac{1}{2(1-\gamma)} \right] - \frac{2}{1 + \frac{\gamma}{1-\gamma} \frac{1}{2}} \right) \\ &= \frac{1}{2\gamma+2} \frac{10 + \gamma - 19\gamma^2 + 10\gamma^3}{(1-\gamma)^2(2-\gamma)} > 0 \text{ for } \forall \gamma \in (0, 1). \end{aligned}$$

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