21COE-GLOPE Working Paper Series

Strategic Choice of Corporate Tax Base

Tomohiro Inoue

Working Paper No. 24

Strategic Choice of Corporate Tax Base

Tomohiro Inoue*

August, 2007

Abstract

We analyze the policy competition between the home and host countries of a multinational firm. Each country imposes a corporate tax on the firm and chooses its tax base for maximizing national welfare. We examine two cases. First, we suppose that only the subsidiary of the multinational firm produces goods; its parent firm does not produce. Second, both the parent and subsidiary firms produce goods. In the first case, both the countries do not choose their tax bases, which are less than the pre-tax profit of the multinational firm. However, in the second case, the home country can choose such a tax base.

1 Introduction

This paper investigates corporate tax bases that are decided under international policy competition. More precisely, we suppose that there exists one multinational firm, on which the home and host countries of the firm impose corporate taxes. We examine the corporate tax bases of both countries when there is strategic interaction between them. In such a case, international double taxation relief methods play a crucial role in the decision of both countries. We employ three methods of the relief and account for their differential impact under alternative methods.

The recent corporate tax reforms in developed countries have a tendency to reduce the tax rate and to broaden the tax base (see Devereux et al., 2002). The literature on corporate tax have explained this tendency in terms of focusing on two types of behaviors on the part of multinational firms. One such behavior is profit shifting. Multinational firms obtain higher post-tax profits by shifting their pre-tax profits from a high-tax country to a low-tax one. Since this behavior decreases the tax revenue of the high-

---

*Graduate School of Economics, Waseda University,   E-mail: tomo-ino@suou.waseda.jp

tax country, countries reduce their tax rates in order to prevent the outflow of profits. Accordingly, they broaden their tax bases in order to cover the reductions of their tax revenues. Haufler and Schjelderup (2000) assume that a multinational firm shifts its profit between countries through transfer pricing. They show that the profit shifting between countries reduces their tax rates, and their tax bases become larger than the pre-tax profit of the firm in equilibrium. In addition, Fuest and Hemmelgarn (2005) suppose profit shifting through thin capitalization and demonstrate the same result.

The other is the choice of location. Other things being equal, multinational firms choose to locate to a country that imposes a lower tax burden in order to maximize their post-tax profits. Since the country to which the firms locate reaps benefits from them in forms such as tax revenue, each country reduces its corporate tax rate. Bond (2000) supposes the situation wherein a multinational firm chooses either foreign direct investment or export for supplying its products to a foreign country. He shows that when a country imposes a higher tax rate on the multinational firm, the firm selects to export its products. Since the multinational firm ascribes the transportation costs to the selling price, the country's national welfare decreases. Hence, each country reduces its tax rate and broadens its tax base in order to cover the reduction of its tax revenue.[1]

These studies do not consider the market power of multinational firms. Although the number of the multinational firms is growing in recent years, it is not considerably large such that their market power can be ignored. In fact, a small number of firms dominate a market such as the automobile industry and the energy industry. Thus, we analyze the effects of corporate tax on multinational firms in the context of imperfect competition. Most studies on corporate tax reform do not assume the existence of the firms that have market power. One exception is Janeba (1996). He assumes a duopoly in which one multinational firm competes against one local firm, and the home and host countries of the multinational firm impose corporate taxes on the firms for maximizing their national welfare. Then, he primarily analyzes which tax system is chosen by the home country.

However, his analysis contains two simplifications. First, most of the paper assumes that both countries choose their corporate tax rates under the exogenously given tax bases, even though he is mainly concerned with the effects of the tax systems on a single industry. Since a corporate tax applies to the industry as a whole and is imposed at a uniform rate, it can not be adjusted depending on the characteristics of an individual industry. Thus, it is not appropriate to analyze the tax rates in order to consider the effects on an individual industry. Second, Janeba (1996) does not clearly explain the decision of the host country.[2] He considers strategic interaction between the multinational firm and the local firm, and

---

[1] There are some other studies in this field. For instance, Devereux and Hubbard (2003) studies the effects of methods of double taxation relief on the location choice of multinational firms.

[2] In this regard, however, he also analyzes the case in which there are multiple industries.

thus, he cannot explicitly demonstrate the equilibrium outcome because the interaction complicates the decision of each country.

Therefore, we suppose that each country decides on not the corporate tax rate but tax base. This is because the corporate tax base can be adjusted depending on the characteristics of an individual industry such as investment tax credits and depreciation allowances depending on the industry. In addition, we also assume that only one multinational firm produces goods. By doing so, the competition between firms disappears, and thus, we can show the choice of the host country and the equilibrium outcome. Accordingly, we employ a model in which the home and host countries of the multinational firm choose their corporate tax base and the firm decides its output level.

Since both the home and host countries tax the multinational firm, its profit is subject to international double taxation. Thus, in this paper, we treat three methods of double taxation relief: the exemption system, the foreign tax credit system and the deduction system. The OECD Double Taxation Convention advocates the application of the former two methods (see OECD, 1997) and, in fact, most countries comply with this. We also consider the deduction system since some countries apply this method and many studies on the double taxation relief from the seminal work of Feldstein and Hartman (1979) consider it.[3]

This paper is organized as follows. In the next section, we present our model. Section 3 analyzes the equilibrium tax base and presents two propositions. In Section 4, we extend our basic model and compare the result with the equilibrium strategy of each country in Section 3. Section 5 concludes.

2   The model

We consider a monopoly model with one multinational firm and three countries. The multinational parent firm is located in Country A (home country), and its subsidiary in Country B (host country). This multinational firm produces goods through only the subsidiary and exports them to the third country. The parent firm receives profit from the subsidiary; the parent firm itself does not produce.[4] The subsidiary's output is denoted by x, its cost function is $C(x)$, and the inverse demand function in the third country is $P(x)$. Let us make the following assumption.

Assumption 1. *The inverse demand function $P(x)$ and the cost function $C(x)$ respectively satisfy*

---

[3]There is a considerable amount of literature on the international double taxation relief methods. See *e.g.*, Hamada (1966), Bond and Samuelson (1989), Janeba (1995), Fuest and Huber (2002), and Dickescheid (2004).

[4]We suppose, for instance, that the third country imposes a very high tariff on the imports from Country A. In such a case, the export of the parent firm is inefficient. In section 4, we consider the case where the parent firm also produces homogeneous goods.

(a) $P'(x) < 0$, $P''(x) \leq 0$ *and*

(b) $C'(x) > 0$, $C''(x) > 0$.

Country i imposes the following corporate tax, T_i, on the multinational firm.

$$T_i \equiv t_i(P(x)x - \alpha_i C(x)) \quad i = A, B,$$

where t_i is the tax rate of Country i, and $t_i \in (0,1)$ is exogenously given in this paper. Each country decides the tax base, $P(x)x - \alpha_i C(x)$, by choosing the parameter α_i. $\alpha_i C(x)$ is the tax-deductible cost. Thus, we define α_i as *the tax-deductible rate* and assume that $\alpha_i \geq 0$. When $\alpha_i = 1$, the corporate tax of Country i is a pure profit tax. Then, the tax base is equal to the pre-tax profit of the firm and the taxation does not change its output level. When $\alpha_i < 1$, the tax-deductible cost is less than the actual cost, that is, the tax base is larger than the pre-tax profit. This could represent the case with incomplete deduction of interest payments and/or depreciation expenses.[5] Inversely, when $\alpha_i > 1$, the tax-deductible cost is more than the actual cost. The tax system with investment tax credits and/or accelerated depreciation corresponds to this case. We consider the decision of the tax base as the choice of the tax-deductible rate.[6]

The subsidiary repatriates the net-of-tax profit to the parent firm, and then, Country A taxes it. The post-tax profit of the multinational firm depends on not only the corporate tax system of each country but also international double taxation relief methods. We treat the following three methods:

1. the exemption system (Method E),

2. the foreign tax credit system (Method C), and

3. the deduction system (Method D).

The tax refund in Method j, R^j, is described in Table 1 ($j = E, C, D$). Under the exemption system, countries tax the profits generated by domestic production but not those earned abroad. Thus, Country A does not tax the repatriated profit, and the tax refund in the exemption system is equal to the corporate tax in the country ($R^E = T_A$). Under the credit system, taxes paid abroad are credited against domestic taxes unless the foreign tax payments are higher than the domestic. In other words, if $T_A \geq T_B$, then $R^C = T_B$. However, when the foreign tax payments exceed the domestic tax liability, the profit is exempted from domestic taxation as with the exemption system. Thus, if $T_A < T_B$, then $R^C = T_A$. We

[5] For instance, the tax system that does not deduct the opportunity cost of equity capital corresponds to this case.

[6] In the conventional analysis of corporate tax inspired by the seminal works of Jorgenson (1963) and Hall and Jorgenson (1967), researchers have an interest in the user cost of capital; they examine how the investment cost should be deducted in corporate tax systems. Thus, the tax-deductible cost is normally described as the product of the investment cost and the tax-deductible rate α_i, as in Haufler and Schjelderup (2000). However, since this paper also investigates the effect of imperfect competition in the market, we substitute the cost function for the investment cost as in Janeba (1996).

Table 1: International double taxation relief

	Tax refund (R^j)
exemption ($j = E$)	$t_A(P(x)x - \alpha_A C(x))$
credit ($j = C$)	$\begin{cases} t_B(P(x)x - \alpha_B C(x)) & \text{if } T_A \geq T_B \text{ (Case 1)} \\ t_A(P(x)x - \alpha_A C(x)) & \text{if } T_A < T_B \text{ (Case 2)} \end{cases}$
deduction ($j = D$)	$t_A t_B(P(x)x - \alpha_B C(x))$

label the former case as Case 1, and the latter case Case 2. In Case 1, the output is affected by the tax system of Country A; and in Case 2, by the tax system of Country B. Under the deduction system, the foreign tax paid is deducted from the domestic corporate tax base.

The multinational firm's profit net of all taxes is given by

$$\Pi^j = P(x)x - C(x) - T_A - T_B + R^j$$
$$= \begin{cases} (1 - t_B)P(x)x - (1 - t_B\alpha_B)C(x) & j = E, \\ (1 - t_A)P(x)x - (1 - t_A\alpha_A)C(x) & j = C \text{ and } T_A \geq T_B, \\ (1 - t_B)P(x)x - (1 - t_B\alpha_B)C(x) & j = C \text{ and } T_A < T_B, \\ (1 - t_A)(1 - t_B)P(x)x - (1 - t_A\alpha_A - t_B\alpha_B + t_A t_B\alpha_B)C(x) & j = D. \end{cases} \quad (1)$$

In each method, the multinational firm chooses the output level that maximizes Equation (1).

Country i chooses the tax-deductible rate α_i with the aim of maximizing its national welfare, as follows.

$$W_A^j = (1 - t_B)P(x) - (1 - t_B\alpha_B)C(x), \quad (2)$$

$$W_B^j = t_B(P(x)x - \alpha_B C(x)) \quad j = E, C, D, \quad (3)$$

where W_i^j denotes the national welfare of Country i in Method j. The national welfare of Country A is the repatriated profit of the multinational firm. Thus, the corporate tax revenue of Country A does not appear since the revenue and the tax burden of the firm cancel out on its national welfare. On the other hand, the national welfare of Country B is its corporate tax revenue.[7] α_A does not appear in Equations (2) and (3), and thus, it does not have a *direct* effect on both countries' national welfare. However, except for the exemption system, α_A could affect the profit of the firm. Accordingly, α_A has an *indirect* effect on the national welfare of both countries through a change in the output that the firm decides on.

---

[7]The national welfare of the third country is consumer surplus.

We consider a two-stage game: In the first stage, each country chooses its tax-deductible rate simultaneously, and in the second stage, the multinational firm chooses its output.

3 The result

3.1 2nd stage: Multinational firm

First, we consider the profit maximization problem. Since the multinational firm maximizes its post-tax profit by choosing its output, we obtain the following first-order conditions.[8]

$$\Pi_x^E = (1 - t_B)\left[P'x + P - \left\{1 + \frac{t_B(1 - \alpha_B)}{1 - t_B}\right\}C'\right] = 0, \tag{4a}$$

$$\Pi_x^C = \begin{cases} (1 - t_A)\left[P'x + P - \left\{1 + \frac{t_A(1 - \alpha_A)}{1 - t_A}\right\}C'\right] = 0 & \text{if Case 1,} \\ (1 - t_B)\left[P'x + P - \left\{1 + \frac{t_B(1 - \alpha_B)}{1 - t_B}\right\}C'\right] = 0 & \text{if Case 2,} \end{cases} \tag{4b}$$

$$\Pi_x^D = (1 - t_A)(1 - t_B)\left[P'x + P - \left\{1 + \frac{t_A(1 - \alpha_A) + (1 - t_A)t_B(1 - \alpha_B)}{(1 - t_A)(1 - t_B)}\right\}C'\right] = 0, \tag{4c}$$

where Π_x^j ($j = E, C, D$) denotes the partial derivative of the post-tax profit in Method j with respect to x. As shown by these conditions, in the exemption system and the credit system of Case 2 ($T_A < T_B$), the output level is affected only by the tax system of Country B, whereas in the credit system of Case 1 ($T_A \geq T_B$), it is affected only by the tax system of Country A. In the deduction system, both countries' tax systems could affect the output level.

Let us make the following assumption.

Assumption 2. *Under all the three methods of double taxation relief, the following two conditions hold.*

(a) $\Pi_{xx}^j < 0$ and

(b) $x^j(\alpha_A, \alpha_B) > 0 \quad j = E, C, D$,

where $x^j(\alpha_A, \alpha_B)$ denotes the equilibrium output in the second stage.

Assumption 2 ensures that the second-order condition for the interior maximum is satisfied.[9]

Under Assumptions 1 and 2, we show the comparative statics of the equilibrium output as follows.

$$\frac{\partial x^j(\alpha_A, \alpha_B)}{\partial \alpha_A} = \begin{cases} -\frac{t_A C'(x^j)}{\Pi_{xx}^j} > 0 & \text{if } j = D, \text{or } C \text{ of Case 1,} \\ 0 & \text{if } j = E, \text{or } C \text{ of Case 2,} \end{cases} \tag{5}$$

---

[8] For notational convenience, the arguments in inverse demand and cost are sometimes omitted.

[9] When $\alpha_i > 1$ and t_i is sufficiently large, the second derivative condition, Assumption 2-(a), can be violated.

$$\frac{\partial x^j(\alpha_A, \alpha_B)}{\partial \alpha_B} = \begin{cases} 0 & \text{if } j = C \text{ of Case 1,} \\ -\frac{t_B C'(x^j)}{\Pi_{xx}^j} > 0 & \text{if } j = E, \text{ or } C \text{ of Case 2,} \\ -\frac{t_B(1-t_A)C'(x^j)}{\Pi_{xx}^j} > 0 & \text{if } j = D. \end{cases} \quad (6)$$

If the tax system of Country i affects the output of the multinational firm, the equilibrium output $x^j(\alpha_A, \alpha_B)$ is an increasing function of the tax-deductible rate α_i. In other words, narrowing the tax base increases the equilibrium output level.

3.2   1st stage: Country A

Each country maximizes its national welfare by choosing the tax-deductible rate in considering Equations (5) and (6). Note that since Country A does not tax the profit in the exemption system, we do not consider the choice of α_A in the method.

3.2.1   The credit system

We classified the credit system into two cases. Case 1 is $T_A \geq T_B$; the equilibrium output is affected by the tax system of Country A in this case. On the other hand, Case 2 is $T_A < T_B$; in this case, only Country B's tax system can affect the equilibrium output. We show the first-order condition for welfare maximization in each case.

Case 1 ($T_A \geq T_B$)   We evaluate Equation (2) at $x = x^C(\alpha_A, \alpha_B)$ and differentiate the equation with respect to α_A to obtain the first-order condition. Regardless of the methods of double taxation relief, we assume the existence of equilibrium in the first stage.

$$\frac{\partial W_A^C}{\partial \alpha_A} = \left\{ \frac{(1-t_B)(1-t_A\alpha_A) - (1-t_A)(1-t_B\alpha_B)}{1-t_A} \right\} C' \frac{\partial x^C}{\partial \alpha_A} \leq 0.$$

If strict inequality is valid, the national welfare of Country A is maximized at $\alpha_A = 0$. Otherwise, we can obtain the following reaction function:

$$\alpha_A = R_A(\alpha_B) = \frac{t_A - t_B + t_B(1-t_A)\alpha_B}{t_A(1-t_B)}. \quad (7)$$

Note that $\alpha_A \geq 0$; thus, if the RHS of Equation (7) is negative, the equilibrium tax-deductible rate $\alpha_A = 0$.

Case 2 ($T_A < T_B$)   In this case, the tax system of Country A does not affect the output. Thus, national welfare is not affected by α_A, and we are unable to obtain the equilibrium tax-deductible rate of Country A in Case 2.

3.2.2   The deduction system

Country A chooses $\alpha_A = 1$ independent of the Country B's tax-deductible rate α_B since the first-order condition for welfare maximization is as follows.

$$\frac{\partial W_A^D}{\partial \alpha_A} = \left\{ \frac{t_A(1-\alpha_A)C'}{1-t_A} \right\} \frac{\partial x^D}{\partial \alpha_A} = 0.$$

3.3   1st stage: Country B

3.3.1   The exemption system

Since Country A does not tax the profit of the multinational firm, only the tax system of Country B can affect the equilibrium outcome. We evaluate Equation (3) at $x = x^E(\alpha_A, \alpha_B)$ and differentiate the equation with respect to α_B to obtain the first-order condition.

$$\frac{\partial W_B^E}{\partial \alpha_B} = \left\{ \frac{t_B(1-\alpha_B)C'}{1-t_B} \right\} \frac{\partial x^E}{\partial \alpha_B} - t_B C = -t_B \left\{ \frac{t_B(1-\alpha_B)(C')^2}{(1-t_B)\Pi_{xx}^E} + C \right\} \leq 0. \tag{8}$$

If strict inequality is valid, the national welfare of Country B is maximized at $\alpha_B = 0$. Otherwise, the condition for welfare maximization is expressed by

$$\alpha_B = 1 + \frac{(1-t_B)C\Pi_{xx}^E}{t_B(C')^2} < 1.$$

Therefore, the equilibrium value of α_B is less than 1. This is explained as follows: When $\alpha_B = 1$, the tax base is neutral with respect to the firm's choice of output and the output level chosen is equal to the no-tax case. Then, the pre-tax profit is maximized. If Country B raises α_B from 1, its tax revenue decreases because of the reduction in the pre-tax profit and the tax base. On the other hand, by reducing α_B slightly from 1, the tax revenue increases because it can broaden the tax base without affecting the pre-tax profit. Thus, the equilibrium tax-deductible rate of Country B is less than 1. In other words, Country B chooses a broad tax base as compared to the pre-tax profit.

3.3.2   The credit system

Case 1 ($T_A \geq T_B$)   The first-order condition for welfare maximization is given by

$$\frac{\partial W_B^C}{\partial \alpha_B} = t_B \left\{ \frac{1 - t_A\alpha_A - \alpha_B(1-t_A)}{1-t_A} \right\} \frac{\partial x^C}{\partial \alpha_B} - t_B C = -t_B C < 0.$$

Since the choice of α_B does not affect the output level, Country B chooses the broadest tax base possible. Thus, α_B is minimized within $T_A \geq T_B$.

Case 2 ($T_A < T_B$)   Since only the tax system of Country B can affect the quantity choice of the multinational firm, the first-order condition is equal to Equation (8). Note that if α_B is sufficiently large, T_B becomes less than T_A. Hence, α_B is limited to a ceiling.[10]

3.3.3   The deduction system

The first-order condition is as follows.

$$\frac{\partial W_B^D}{\partial \alpha_B} = t_B \left\{ \frac{1 - t_A \alpha_A - \alpha_B(1 - t_A)}{1 - t_A} \right\} \frac{\partial x^D}{\partial \alpha_B} - t_B C = -t_B \left[\frac{\{1 - \alpha_B - t_A(\alpha_A - \alpha_B)\}(C')^2}{(1 - t_B)\Pi_{xx}^D} + C \right] \leq 0.$$

If strict inequality is valid, the national welfare of Country B is maximized at $\alpha_B = 0$. Otherwise, we can obtain the following condition.

$$\alpha_B = \frac{(1 - t_A \alpha_A)(C')^2 + (1 - t_B)C\Pi_{xx}^D}{(1 - t_A)(C')^2}.$$

3.4   Equilibrium

Using the above conditions, we obtain the tax-deductible rates of both countries in equilibrium. In this subsection, we specify the inverse demand function and the cost function as follows:[11]

Assumption 3. *The inverse demand function $P(x)$ is linear, and the cost function $C(x)$ is quadratic. They are expressed as follows.*

(a) $P(x) = a - x$ and

(b) $C(x) = x^2$,

where $a > 0$.

3.4.1   The exemption system

By Assumption 3, the equilibrium output is given by

$$x^E = \frac{a(1 - t_B)}{2(2 - t_B - t_B \alpha_B)}.$$

Evaluating Equation (3) at this value of x, we can obtain the equilibrium tax-deductible rate of Country B in the exemption system.

$$\alpha_B^E = -\frac{2 - 5t_B + t_B^2}{t_B(1 + t_B)}. \tag{9}$$

---

[10]Since each country maximizes its national welfare, they desire to realize the case that yields a higher level of welfare. We need to consider which case is realized. However, thus far, we do not obtain sufficient conditions to do it. Thus, we analyze it based on an additional assumption in Subsection 3.4.

[11]The specification in Assumption 3 satisfies Assumption 1.

We describe the equilibrium tax-deductible rate of Country i in Method j as α_i^j ($i = A, B$; $j = E, C, D$). If the tax rate of Country B is sufficiently small ($t_B \leq (5 - \sqrt{17})/2$), the RHS of Equation (9) is negative, and then, the equilibrium tax-deductible rate is zero ($\alpha_B^E = 0$). The equilibrium national welfare (W_A^E, W_B^E) is as follows.

$$(W_A^E, W_B^E) = \begin{cases} \left(\frac{a^2(1-t_B)(1+t_B)}{16}, \ \frac{a^2(1+t_B)^2}{32} \right) & \text{if} \quad t_B > \frac{5-\sqrt{17}}{2}, \\ \left(\frac{a^2(1-t_B)^2}{4(2-t_B)}, \ \frac{a^2 t_B(1-t_B)(3-t_B)}{4(2-t_B)^2} \right) & \text{otherwise.} \end{cases}$$

3.4.2 The credit system

Case 1 ($T_A \geq T_B$) The equilibrium output is

$$x^C = \frac{a(1 - t_A)}{2(2 - t_A - t_A \alpha_A)},$$

and the reaction function of Country A is given by

$$\alpha_A = R_A(\alpha_B) = \frac{t_A - t_B + t_B(1 - t_A)\alpha_B}{t_A(1 - t_B)}.$$

This is equal to Equation (7). On the other hand, Country B chooses the smallest tax-deductible rate possible, and thus, $\alpha_B = 0$. Since the country wishes to choose this rate for any $t_A \in (0, 1)$, if $t_A < t_B$, Case 1 is not realized (Case 2 is realized). Hence, when $t_A < t_B$, there is no equilibrium in Case 1.

Each country chooses the following tax-deductible rate in Case 1.

$$(\alpha_A, \alpha_B) = \left(\frac{t_A - t_B}{t_A(1 - t_B)}, \ 0 \right) \quad \text{if} \quad t_A \geq t_B, \tag{10}$$

and the national welfare of both countries is as follows.

$$(W_A, W_B) = \left(\frac{a^2(1 - t_B)^2}{4(2 - t_B)}, \ \frac{a^2 t_B(1 - t_B)(3 - t_B)}{4(2 - t_B)^2} \right). \tag{11}$$

Case 2 ($T_A < T_B$) Since only the tax system of Country B has an effect on the output of the multinational firm, Case 2 is identical to the exemption system except for the constraint $T_A < T_B$. Thus, the tax-deductible rate that Country B chooses is given by

$$\alpha_B = -\frac{2 - 5t_B + t_B^2}{t_B(1 + t_B)}. \tag{12}$$

Note that when the tax rate of Country B is sufficiently small ($t_B \leq (5 - \sqrt{17})/2$), $\alpha_B = 0$. The national welfare of both countries (W_A, W_B) are as follows.

$$(W_A, W_B) = \begin{cases} \left(\frac{a^2(1-t_B)(1+t_B)}{16}, \ \frac{a^2(1+t_B)^2}{32} \right) & \text{if} \quad t_B > \frac{5-\sqrt{17}}{2}, \\ \left(\frac{a^2(1-t_B)^2}{4(2-t_B)}, \ \frac{a^2 t_B(1-t_B)(3-t_B)}{4(2-t_B)^2} \right) & \text{otherwise.} \end{cases} \tag{13}$$

Finally, we consider the selection between the two cases. For instance, in Case 1, if Country A can obtain a higher national welfare than that shown in Equation (11) by raising α_A to such an extent that Case 2 is realized, then the above result in Case 1 is not the equilibrium in the credit system. Thus, we need to consider the incentives for both countries to deviate from the strategy as described above.

First, we examine the incentives for the two countries to deviate from Case 1. In this case, since Country B already chooses $\alpha_B = 0$, it cannot deviate by reducing α_B. Hence, we consider only the incentive for Country A that might deviate from Case 1 by raising α_A. However, if the country raises α_A to such an extent that Case 2 is realized, its welfare level does not improve strictly. Therefore, Equations (10) and (11) show the tax-deductible rates and the national welfare in equilibrium.

Second, we analyze the incentives to deviate from Case 2. Note that, in Case 2, Country A does not choose α_A since the choice does not affect its national welfare. Thus, it is not clear whether Case 1 is realized or not when α_B takes a certain value. Accordingly, we assume that Country B does not have the incentive to deviate from Case 2. On the other hand, we can investigate the incentive for Country A. If Country A chooses a sufficiently low α_A to such an extent that Case 1 is realized, its welfare level does not improve strictly. Therefore, Equations (12) and (13) also show the tax-deductible rate and the national welfare in equilibrium.

3.4.3 The deduction system

The equilibrium output in this method is given by

$$x^D = \frac{a(1 - t_A)(1 - t_B)}{2(2 - t_A - t_B + t_A t_B - t_A \alpha_A - t_B \alpha_B + t_A t_B \alpha_B)}.$$

The reaction functions of both the countries are as follows.

$$\alpha_A = R_A(\alpha_B) = 1,$$
$$\alpha_B = R_B(\alpha_A) = -\frac{2 - t_A - 5t_B + 2t_A t_B + t_B^2 - t_A t_B^2 - t_A \alpha_A + 3t_A t_B \alpha_A}{t_B(1 - t_A)(1 + t_B)}.$$

Therefore, we obtain the following equilibrium outcomes.

$$(\alpha_A^D, \alpha_B^D) = \begin{cases} \left(1, \ -\frac{2 - 5t_B + t_B^2}{t_B(1 + t_B)}\right) & \text{if} \quad t_B > \frac{5 - \sqrt{17}}{2}, \\ \\ (1, \ 0) & \text{otherwise}, \end{cases} \tag{14}$$

$$(W_A^D, W_B^D) = \begin{cases} \left(\frac{a^2(1 - t_B)(1 + t_B)}{16}, \ \frac{a^2(1 + t_B)^2}{32}\right) & \text{if} \quad t_B > \frac{5 - \sqrt{17}}{2}, \\ \\ \left(\frac{a^2(1 - t_B)^2}{4(2 - t_B)}, \ \frac{a^2 t_B(1 - t_B)(3 - t_B)}{4(2 - t_B)^2}\right) & \text{otherwise}. \end{cases}$$

3.5 Proposition

We obtain two propositions by comparing the three methods of double taxation relief.

Proposition 1. *Under Assumptions 2 and 3, the tax-deductible rate in equilibrium is $\alpha_i \leq 1$ $(i = A, B)$ independent of the methods of double taxation relief. However, the tax-deductible rate of Country A in the credit system of Case 2 is not decided.*

First, we consider Country B. The national welfare of the country is the corporate tax revenue, and thus it maximizes the tax revenue. We explain the intuition behind Proposition 1 by dividing the effect, namely, the effect of an alteration of the tax-deductible rate α_B on national welfare, into *direct* and *indirect* effects. The direct effect is that the alteration changes the tax revenue under the constant pre-tax profit of the multinational firm. For instance, the reduction of α_B (*viz.* the broadening of the tax base) always increases the tax revenue of Country B in the direct effect. The indirect effect is that the alteration changes the tax revenue through the change in the output and the pre-tax profit. Unlike the direct effect, the reduction of α_B does not always increase the tax revenue. It is dependent on the value of α_B, irrespective of whether the tax revenue increases or decreases in the indirect effect. When α_B is larger than 1, the equilibrium output level is excessive as compared to the no-tax case since the cost is deducted from the tax base excessively. Thus, the reduction of α_B decreases the output and increases the pre-tax profit and the tax revenue. Inversely, when α_B is less than 1, the reduction of α_B decreases the pre-tax profit and tax revenue. To sum up, when Country B changes the tax-deductible rate from $\alpha_B = 1$, the indirect effect turns into the tax revenue reduction effect.

Considering the direct and indirect effects, we can understand why Country B chooses $\alpha_B < 1$. At $\alpha_B = 1$, the marginal reduction in α_B increases the tax revenue by the direct effect while the indirect effect does not work. Thus, the corporate tax revenue of Country B increases by choosing the tax-deductible rate less than 1. As concerns in the deduction system, we cannot explain Proposition 1 by the above two effects because the tax-deductible rate of Country A also affects the decision of the multinational firm. However, in equilibrium, Country A chooses $\alpha_A = 1$, and then the tax system of the country does affect the decision-making of the multinational firm. Therefore, the result is the same as that in the exemption system and the credit system.

On the other hand, the national welfare of Country A is the repatriated profit of the multinational firm. As stated in Section 2, the tax-deductible rate of Country A does not *directly* affect its national welfare, and thus, the country chooses α_A in consideration of the *indirect* effect through the change in the output and the pre-tax profit. Since this indirect effect depends on the the tax system of both the countries, it is difficult to explain Proposition 1 by this effect. Therefore, we describe it as follows: In

all the methods, Country B decides the tax base, which is larger than the pre-tax profit of the firm. If Country A raises α_A, Country B obtains most of the tax revenue from the incremental profit, and the national welfare of Country A does not improve. Therefore, Country A does not choose $\alpha_A > 1$.

Proposition 1 can also be proved by Assumption 1 instead of Assumption 3. Thus, this proposition is robust against the specification of functions. Meanwhile, we can compare the output and national welfare in each method by specifying the functions. As a result, we obtain the following proposition.

Proposition 2. *Under Assumptions 2 and 3, the equilibrium output and the equilibrium national welfare of both countries in each method of double taxation relief are as follows.*

$$x^E = x^{C2} = x^D \geq x^{C1}.$$

$$W_i^E = W_i^{C2} = W_i^D \geq W_i^{C1},$$

where x^{Cj} and W_i^{Cj} ($i = A, B$; $j = 1, 2$) denote the equilibrium output and equilibrium national welfare in the credit system of Case j. The strict inequality is valid only if $t_B > (5 - \sqrt{17})/2$.

If an equilibrium exists in the credit system of Case 2, the outcome coincides with that in the exemption system. Moreover, in the deduction system, the equilibrium outcome coincides with it since Country A chooses $\alpha_A = 1$ in equilibrium. However, in the credit system of Case 1, the level of national welfare in each country is less than that in the case of the other methods, provided $t_B > (5 - \sqrt{17})/2$. In this case, the tax system of Country B does not affect the decision of the multinational firm, and the country chooses a broad tax base ($\alpha_B^C = 0$) as compared with the others. Since this choice of Country B reduces the tax-deductible rate of Country A, the pre-tax profit in this case is lower than that in the others.[12] Note that if t_B is sufficiently small ($t_B \leq (5 - \sqrt{17})/2$), the national welfare of each method becomes equal.

By Proposition 2, the total welfare of the both countries in the credit system of Case 1 is the lowest in the methods of double taxation relief. In addition, since the same applies to the output, world welfare which is the sum of the national welfare of the three countries takes the same order as the individual national welfare.

These two propositions have two features. One is that the credit system could be undesirable for the three countries (the home, the host, and the third country). This is because Country B does not deduct the firm's cost from the tax base in Case 1 ($\alpha_B = 0$). In this case, since the host country tax does not affect the output level, the expansion of the tax base always increases its tax revenue (only the direct effect is active). Therefore, the tax-deductible rate of Country A falls and the pre-tax profit of the multinational firm decreases.

---

[12]As expressed in Equation (7), α_A is the increasing function of α_B.

The other feature is that the equilibrium tax-deductible rate is less than or equal to 1 and in the deduction system, α_A is equal to 1. We can provide a rough explanation of $\alpha_A^D = 1$ as follows: Comparing the national welfare of Country A in the exemption system, in which only the tax system of Country B affects the decision of the multinational firm, with that in the credit system of Case 1, in which only the tax system of Country A affects the decision, the welfare in the exemption system is higher. Therefore, Country A chooses $\alpha_A = 1$ such that its tax system does not affect the decision of the firm.

Thus far, we have considered the decision of the tax-deductible rate based on the model as described in Section 2. In the model, the tax base of Country A is not decided in the exemption and credit system of Case 2. This is because the firm that makes a profit in Country A does not exist. Accordingly, in the next section, we suppose that the parent firm that locates to Country A also produces homogeneous goods and exports them to the third country.

4 The production in the parent and subsidiary

The aim of this section is to examine the effect that the production activities of the parent firm have on the tax-deductible rates in the exemption system. In the previous model, Country A does not tax the multinational firm in the exemption system since the parent firm does not generate profits by itself. Thus, we consider the tax-deductible rate of Country A when the parent firm also produces homogeneous goods, and examine the effect of the production activities on the strategy of Country B. Let y denote the output of the parent firm; further, we assume that the cost function of the firm is identical to that of the subsidiary. The total profit of the multinational firm $\widetilde{\Pi}^E$ and the national welfare of both countries $\widetilde{W}_A^E$ and $\widetilde{W}_B^E$ are expressed by

$$\widetilde{\Pi}^E = (1 - t_A)P(x + y)y - (1 - t_A\alpha_A)C(y) + (1 - t_B)P(x + y)x - (1 - t_B\alpha_B)C(x),$$

$$\widetilde{W}_A^E = P(x + y)y - C(y) + (1 - t_B)P(x + y)x - (1 - t_B\alpha_B)C(x),$$

$$\widetilde{W}_B^E = t_B(P(x + y)x - \alpha_B C(x)).$$

The multinational firm decides x and y in order to maximize its post-tax profit. At this point, we assume sufficient conditions for the existence of equilibrium in the second stage.

Assumption 4. *The profit function $\widetilde{\Pi}^E$ is twice differentiable and it satisfies the following conditions.*

(a) $\widetilde{\Pi}_{xx}^E < 0$, $\widetilde{\Pi}_{yy}^E < 0$,

(b) $\Delta \equiv \widetilde{\Pi}_{xx}^E \widetilde{\Pi}_{yy}^E - (\widetilde{\Pi}_{xy}^E)^2 > 0$, and

(c) $\tilde{x}^E(\alpha_A, \alpha_B) > 0$ and $\tilde{y}^E(\alpha_A, \alpha_B) > 0$.

where $\tilde{x}^E(\alpha_A, \alpha_B)$ and $\tilde{y}^E(\alpha_A, \alpha_B)$ denote the equilibrium outputs of the parent firm and the subsidiary in the second stage, respectively.

Under Assumptions 1 and 4, we show the comparative statics of the equilibrium outputs as follows.

$$\begin{cases} \frac{\partial \tilde{x}^E}{\partial \alpha_A} = \frac{t_A C'(\tilde{y}^E)\Gamma}{\Delta} < 0, & \frac{\partial \tilde{y}^E}{\partial \alpha_A} = -\frac{t_A C'(\tilde{y}^E)\tilde{\Pi}^E_{xx}}{\Delta} > 0, \\ \frac{\partial \tilde{x}^E}{\partial \alpha_B} = -\frac{t_B C'(\tilde{x}^E)\tilde{\Pi}^E_{yy}}{\Delta} > 0, & \frac{\partial \tilde{y}^E}{\partial \alpha_B} = \frac{t_B C'(\tilde{x}^E)\Gamma}{\Delta} < 0, \end{cases} \tag{15}$$

$$\text{where} \quad \Gamma \equiv (1 - t_A)(P''\tilde{y}^E + P') + (1 - t_B)(P''\tilde{x}^E + P') < 0.$$

The equilibrium output of the production base located in Country i is an increasing function of α_i but it is a decreasing function of α_j $(i, j = A, B; \ j \neq i)$. For instance, if Country A raises α_A, then the equilibrium output of the parent $\tilde{y}^E$ increases but that of the subsidiary $\tilde{x}^E$ decreases. Intuitively, the post-tax cost of the parent is reduced by raising α_A, and thus, its output increases. The increase of the total output lowers the market price and decreases the profit of the subsidiary. Then, the subsidiary has an incentive to raise the market price by reducing the output. That is, the multinational firm adjusts the production share within the firm.

We obtain the first-order conditions for the welfare maximization of Country A and Country B. The condition of Country A is given by

$$\frac{\partial \widetilde{W}^E_A}{\partial \alpha_A} = t_A P'\tilde{y}^E \frac{\partial \tilde{x}^E}{\partial \alpha_A} - \left\{ \frac{t_A(1 - t_B)P'\tilde{x}^E}{1 - t_A} \right\} \frac{\partial \tilde{y}^E}{\partial \alpha_A} + \left\{ \frac{t_A(1 - \alpha_A)C'(\tilde{y}^E)}{1 - t_A} \right\} \frac{\partial \tilde{y}^E}{\partial \alpha_A} = 0.$$

By Assumption 1 and Equation (15), the first two terms are positive. Therefore, this condition can be satisfied by choosing $\alpha_A > 1$ such that the third term becomes negative.

On the other hand, we cannot obtain the optimal decision of Country B because the first-order condition of this country is

$$\frac{\partial \widetilde{W}^E_B}{\partial \alpha_B} = \left\{ \frac{t_B(1 - \alpha_B)C'(\tilde{x}^E)}{1 - t_B} \right\} \frac{\partial \tilde{x}^E}{\partial \alpha_B} - t_B C(\tilde{x}^E) - \left\{ \frac{t_B(1 - t_A)P'\tilde{y}^E}{1 - t_B} \right\} \frac{\partial \tilde{x}^E}{\partial \alpha_B} + t_B P'\tilde{x}^E \frac{\partial \tilde{y}^E}{\partial \alpha_B} = 0,$$

and thus, there are two factors that determine the value of α_B. One of them is represented by the first two terms. This factor has already appeared in the previous model as well. Roughly speaking, the first term is the indirect effect and the second is the direct effect as stated in Subsection 3.5. In addition, another factor exists in the above condition. This is represented by the last two terms. These show the effects that the tax-deductible rate of Country B has on the adjustment of the multinational firm's production share. With respect to latter factor, the rise of α_B improves the national welfare of Country B; however, in the former factor, it does not necessarily improve the welfare. In particular, when $\alpha_B > 1$, it decreases the welfare. Therefore, we cannot obtain the optimal decision of Country B.[13]

---

[13] If we specify the inverse demand and cost functions as per Assumption 3, we could obtain the reaction function of Country

In contrast to Proposition 1, Country A chooses $\alpha_A > 1$. Each country can raise the production share of the firm located in the country by raising its tax-deductible rate. Since the profit of the firm increases due to the rise in the share, each country has an incentive to raise its tax-deductible rate. In individual terms, the profit of the parent firm is not taxed in Country B, and thus, Country A raises its tax-deductible rate to increase the share of the parent. On the other hand, Country B can tax only the profit of the subsidiary. Thus, it raises α_B to increase the share of the subsidiary. However, since Country B also has an incentive to decrease its tax-deductible rate for maximizing the tax revenue, we cannot clarify its optimal decision. This tax-deductible rate that raises incentives also exists in the other methods of double taxation relief.

5   Conclusion

This paper investigated the policy competition between two countries, in which each country chooses its corporate tax base for maximizing its national welfare. We supposed that one multinational firm operates in both the countries and examined two cases. One is the case where only its subsidiary, which is located in the host country, produces goods, and the other is the case where the multinational parent firm also produces. In the former case, each country chooses the tax base that is larger than or equal to the pre-tax profit of the multinational firm independent of the methods of double taxation relief. In the latter case, each country has an additional incentive to narrow its tax base. In the exemption system, in particular, the home country chooses the tax base that is less than the pre-tax profit of the multinational parent.

Our analysis contributes to the literature on corporate tax in the following two respects. First, we have incorporated the strategic choice of the tax base into the analysis of corporate tax. Most of the literature on international taxation considers tax rate competition but are not concerned with tax base competition. Since we attended to the effects of corporate taxes on the individual industry, it is desirable to focus on the tax base, as stated in Introduction.

Second, this paper has shown that the corporate tax bases of both countries are larger than the pre-tax profit of the multinational firm. This is particularly observed in the host country because it has a strong incentive to raise its tax revenue as compared with the home country. Note that when the parent also produces homogeneous goods, this outcome is not realized due to the factor of production share adjustment, as explained in Section 4. Thus, the strategic choice of corporate tax base might not explain the fact that many countries broaden their tax bases. However, in developed countries, the cross-hauling

---

B. However, since the first-order conditions of both countries are more complicated than that in the previous model, we are unable to obtain an equilibrium.

direct investment has been observed. In such a case, both countries have an incentive to increase their own tax revenues from foreign firms. Therefore, both countries could choose broader corporate tax bases. The analysis of this case is a subject for future research.[14]

This paper intends to investigate the corporate tax base, which is decided in the policy competition between the home and host countries of the multinational firm. As stated above, this viewpoint has been almost ignored in the existing literature. However, researchers in the debate on corporate tax reform — which has proposed some alternatives to the current system such as an Allowance for Corporate Equity (ACE), cash-flow tax, and Comprehensive Business Income Tax (CBIT) — are concerned with the corporate tax base. This paper presented a methodology to fill in the gap.[15] Note, however, that our analysis merely focused on foreign direct investment, which is an approach of the foreign market entry of multinational firms. There are some alternatives such as export and licensing. Therefore, in the future, we need to classify these approaches and examine the effects of the corporate tax systems on the behavior of multinational firms.

References

Bond, E. W. and L. Samuelson, "Strategic Behavior and the Rules for International Taxation of Capital," *Economic Journal*, 1989, *99*, 1099–1111.

Bond, S. R., "Levelling up or Levelling down? Some Reflections on the ACE and CBIT Proposals, and the Future of the Corporate Tax Base," in S. Cnossen, ed., *Taxing Capital Income in the European Union*, Oxford University Press, 2000, pp. 161–179.

Devereux, M. P. and R. G. Hubbard, "Taxing Multinationals," *International Tax and Public Finance*, 2003, *10*, 469–487.

_ , R. Griffith, and A. Klemm, "Corporate Income Tax Reforms and International Tax Competition," *Economic Policy*, 2002, *17*, 450–495.

Dickescheid, T., "Exemption vs. Credit Method in International Double Taxation Treaties," *International Tax and Public Finance*, 2004, *11*, 721–739.

Feldstein, M. and D. Hartman, "The Optimal Taxation of Foreign Source Invest Income," *Quarterly Journal of Economics*, 1979, *93*, 613–629.

---

[14]Mintz and Tulkens (1996) and Fuest and Huber (2002) consider models with the cross-hauling of direct investment.

[15]In this paper, $\alpha_i = 1$ shows that Country i employs the ACE or the cash-flow tax. Besides, when the CBIT is employed, the tax-deductible rate is less than 1 ($\alpha_i < 1$).

Fuest, C. and B. Huber, "Why Capital Income Taxes Survive in Open Economies: The Role of Multinational Firms," *International Tax and Public Finance*, 2002, *9*, 567–589.

_ **and T. Hemmelgarn**, "Corporate Tax Policy, Foreign Firm Ownership and Thin Capitalization," *Regional Science and Urban Economics*, 2005, *35*, 508–526.

Hall, R. E. and D. W. Jorgenson, "Tax Policy and Investment Behavior," *American Economic Review*, 1967, *57*, 391–414.

Hamada, K., "Strategic Aspects of Taxation on Foreign Investment Income," *Quarterly Journal of Economics*, 1966, *80*, 361–375.

Haufler, A. and G. Schjelderup, "Corporate Tax Systems and Cross Country Profit Shifting," *Oxford Economic Papers*, 2000, *52*, 306–325.

Janeba, E., "Corporate Income Tax Competition, Double Taxation Treaties, and Foreign Direct Investment," *Journal of Public Economics*, 1995, *56*, 311–325.

_ , "Foreign Direct Investment under Oligopoly: Profit Shifting or Profit Capturing?," *Journal of Public Economics*, 1996, *60*, 423–445.

Jorgenson, D. W., "Capital Theory and Investment Behavior," *American Economic Review*, 1963, *53*, 247–259.

Mintz, J. and H. Tulkens, "Optimality Properties of Alternative System of Taxation of Foreign Direct Capital Income," *Journal of Public Economics*, 1996, *60*, 373–399.

OECD, *Model Double Taxation Convention on Income and on Capital*, Paris: OECD Committee on Fiscal Affairs, 1997.