Optimal Tourism Tax and Partial Privatization in a Mixed Oligopoly

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【Abstract】

This study examines the optimal tourism tax in which a partially privatized public firm and private firms compete in a mixed oligopoly market. A tourism service produced by these firms is consumed by foreign as well as domestic tourists, and a government imposes a tax on the consumption of the tourism service. We show that the level of the tourism tax that maximizes the host country's welfare depends on the fraction of foreign tourists, the degree of privatization of the public firm, and the number of firms operating in the market. In particular, for a sufficiently higher fraction of foreign tourists, a higher degree of privatization of the public firm, and a larger number of firms in the market, the optimal tourism tax rate can be shown to be positive. Furthermore, it is shown that the optimal tourism tax rate will increase as (a) the fraction of foreign tourists rises, (b) the privatization of the public firm progresses, and (c) the number of firms in the market increases.

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1. Introduction

With the recent boom in tourism, countries are increasingly introducing a tax on tourism. According to UNWTO (1998), a tourism tax, which is a tax on tourism business or directly on tourists, can take various forms and thus have various names.[1] A departure tax is an example of the tourism tax levied on each tourist's departure. That is, when domestic tourists leave their own country or foreign tourists leave for their home country, taxes are collected in the form of being added to their airfare. Although numerous studies empirically examine the tourism tax, few studies consider this issue from the theoretical viewpoint. In particular, a typical tourism industry such as aviation and railways can be described as an imperfectly competitive market rather than a perfectly competitive one, and in some cases, it can be characterized as a mixed oligopolistic market in which a state-owned enterprise and private companies compete. Analyses of the tourism tax from such a viewpoint have not been undertaken so far.

This study investigates the optimal tourism taxes in a mixed oligopoly market in which a partially privatized public firm and private firms compete. In particular, we extend the segmented market model by Brander and Krugman (1983) to include a mixed oligopoly market in which a public firm and private firms provide a tourism service to domestic and foreign

[1] UNWTO (1998) categorizes the tourism tax into 40 different types in 12 sectors, examples of which include a departure tax, a hotel tax, an eco-tourism tax, a casino tax, and so on. See Gooroochurn and Sinclair (2005) and Dwyer et al. (2010) for detailed explanations on the tourism tax.

tourists. Private firms maximize their own profits while a public firm is concerned with social welfare as well as its own profit, and the government, taxing on the consumption of the tourism service, chooses its rate to maximize the social welfare.

We show that the level of the tourism tax that maximizes the host country's welfare depends on the fraction of foreign tourists, the degree of privatization of the public firm, and the number of firms operating in the market. In particular, for a sufficiently higher fraction of foreign tourists, a higher degree of privatization of the public firm, and a larger number of firms in the market, the optimal tourism tax rate can be shown to be positive. Furthermore, it is shown that the optimal tourism tax rate will increase as (a) the fraction of foreign tourists rises, (b) the privatization of the public firm progresses, and (c) the number of firms operating in the market increases. In other words, a country facing a foreign tourism boom, with a higher degree of privatization of the public firm, and with highly competitive market for a tourism service will have a higher tourism tax rate relative to countries without a tourism boom, with a low degree of privatization of its public firm, and with less competitive markets.

This study is related to two strands of literature. The first is on the optimal tourism tax. Hämäläinen (2004) examines the optimal taxation on the tourism goods within the context of Diamond and Mirrlees (1971), and characterizes the optimal tax rules for the tourism goods, the demand for which arise from domestic and foreign consumers. Gooroochurn (2009) also investigates the optimal taxation of tourism goods and characterizes the rule from the viewpoint of equity as well as efficiency. For a study on imperfect competition, Copeland (2012) adopts a third market model to show that for foreign tourists, tourism subsidies (entrance subsidies) rather than taxes can improve the host country's welfare.

The second strand of literature is on the mixed oligopoly market. Most studies that have analyzed this are based on the seminal papers by De Fraja and Delbono (1989) and Matsumura (1998), and their models have been applied to studies in various fields. Chao and Yu (2006) study the optimum tariffs in a mixed oligopoly market to examine how such tariffs are affected by the privatization of the public firm and the increased entry of more firms into the market. As in the current study, Ohori (2004) adopts the segmented market model to examine optimal environmental taxes in two distinct cases in which the public firm is completely nationalized or completely privatized.

The rest of this paper is organized as follows. In the next section, we develop a model of mixed oligopoly with foreign tourists that will be used throughout the analyses. Section 3 examines the equilibrium choices of the firms and the government, derives the optimal tourism tax, and examines its characteristics. Concluding remarks are presented in the final section.

2. Description of the Economy

Consider an economy consisting of two goods, a tourism service x, other good z, and one factor of production, labor. The good z, which is a numeraire good, is produced in a competitive market by labor with constant returns to scale technology. The input-output coefficient is assumed to be one. The tourism service x is produced by labor in a mixed oligopoly market, which consists of one partially privatized public firm, which we call firm 0, and n private firms. We assume that the production technologies (production costs) are identical across firms, including the public firm, and are given by

$$C(x_i) = cx_i + f, \tag{1}$$

where x_i is the amount of tourism service produced by firm i $(= 0, 1, \ldots, n)$, c (> 0) is the marginal cost, and f represents a fixed cost that is assumed to be zero for simplicity. It is further assumed that the market for the tourism service is segmented into domestic and foreign tourists. That is, x_0, the amount of tourism service produced by the public firm, is the sum of h_0, the amount of tourism service supplied for domestic tourists, and e_0, that supplied for foreign tourists (thus, $x_0 = h_0 + e_0$). In addition, x_i, the amount of tourism service produced by a private firm i is the sum of h_i, which is the amount of tourism service supplied for domestic tourists, and e_i, which is that supplied for foreign tourists (thus, $x_i = h_i + e_i$).

Both domestic and foreign tourists consume the tourism services provided by both public and private firms. The fraction of foreign tourists relative to domestic tourists is denoted as β (> 0). We assume that the preferences are identical across the tourists and are given by $u = aq_x - \frac{q_x^2}{2} + q_z$, where q_x and q_z represent the consumption of x and z, respectively, and $a > 0$. A tourism tax t is imposed on the consumption of x. It is assumed that both tourists bear the same rate of the tourist tax.[2] The budget constraint of the domestic tourists can be written as $(p + t)q_x + q_z = I$, where p is the price of x in the domestic tourists' market and I represents the income of these tourists. The utility maximization problem of the domestic tourists is formulated as

$$\max_{q_x, q_z} \; u = aq_x - \frac{q_x^2}{2} + q_z \text{ s.t. } (p + t)q_x + q_z \leq I,$$

which gives the demand for x as $q_x = a-(p+t)$. The optimization problem of the foreign tourists can also be formulated in the same manner, and this gives their demand for x as $q_x^* = a - (p^* + t)$, where p^* represents the price of x in the foreign tourists market.

The market equilibrium condition for the tourism service for domestic

[2] Previous studies examining the effect of the tourism tax, including Hämäläinen (2004) and Gooroochurn (2009), also impose the same assumption.

and foreign tourists' markets can be written, respectively, as

$$q_x = a - (p + t) = h_0 + \sum_{j=1}^{n} h_j, \tag{2}$$

$$\beta q_x^* = \beta \left[a - (p^* + t)\right] = e_0 + \sum_{j=1}^{n} e_j. \tag{3}$$

Solving (2) and (3) for p and p^* yields the inverse demand functions in the domestic and foreign tourists' markets, respectively.

$$p = a - h_0 - \sum_{j=1}^{n} h_j - t, \tag{4}$$

$$p^* = a - \frac{e_0 + \sum_{j=1}^{n} e_j}{\beta} - t. \tag{5}$$

Using (4) and (5), the profit functions of the public firm and the private firm i can be expressed as

$$\pi_0 = \left(a - h_0 - \sum_{j=1}^{n} h_j - t - c\right) h_0 + \left(a - \frac{e_0 + \sum_{j=1}^{n} e_j}{\beta} - t - c\right) e_0, \tag{6}$$

$$\pi_i = \left(a - h_0 - \sum_{j=1}^{n} h_j - t - c\right) h_i + \left(a - \frac{e_0 + \sum_{j=1}^{n} e_j}{\beta} - t - c\right) e_i. \tag{7}$$

For equations (6) and (7), the first term on the right-hand side represents the profit from the domestic tourists' market, while the second represents that from the foreign tourists' market. The consumer surplus from the consumption by the domestic tourists can be expressed as

$$CS = \frac{\left(h_0 + \sum_{j=1}^{n} h_j\right)^2}{2}. \tag{8}$$

The social welfare in the domestic economy is the sum of the consumer surplus, the profits of the public and private firms, and the revenue from the tourism tax (denoted as TR).

$$W = CS + \pi_0 + \sum_{j=1}^{n} \pi_j + TR, \tag{9}$$

where

$$TR = t\left(h_0 + \sum_{j=1}^{n} h_j + e_0 + \sum_{j=1}^{n} e_j\right). \tag{10}$$

This study considers the following two-stage game. In the first stage, the government chooses the tourism tax rate t to maximize the social welfare. In the second stage, each firm determines the amount of tourism services provided. While private firms choose the amount of x to maximize their own profits, the partially privatized public firm decides the amount of x to maximize the weighted sum of social welfare and its own profit. That is, following Matsumura (1998) and others, we write the objective function of the public firm as

$$V = \theta\pi_0 + (1-\theta)W, \tag{11}$$

where θ represents a parameter describing the degree of privatization of the public firm, and is assumed to be $\theta \in [0, 1]$.[3] In the next section, we analyze the model by solving the above game.

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3 When the public firm is fully privatized, then $\theta = 1$ and the objective function of the public firm corresponds to its own profit π_0. On the other hand, if the public firm is fully nationalized, then $\theta = 0$ and the objective function of the public firm coincides with the social welfare W.

3. Equilibrium Choices of the Firms and the Government

In this section, we solve the model constructed in the previous section and analyze the equilibrium choices of the public firm, the private firms, and the government. The solution concept of the above two-period game is the sub-game perfect equilibrium, and this can be solved using backward induction. Section 3.1 focuses on the second-period choices by the firms and section 3.2 analyzes the government's choice of the optimal tourism tax in the first period.

3.1 Second-Period Choices of the Firms

3.1.1 Amount of Tourism Services

First, consider the choice of the private firms. The profit maximization problem of private firm i in the second period is given by

$$\max_{h_i, e_i} \pi_i = \left(a - h_0 - \sum_{j=1}^{n} h_j - t - c \right) h_i + \left(a - \frac{e_0 + \sum_{j=1}^{n} e_j}{\beta} - t - c \right) e_i.$$

The first-order conditions for h_i and e_i can be written, respectively, as

$$\left(a - h_0 - \sum_{j=1}^{n} h_j - t - c \right) - h_i = 0,$$

$$\left(a - \frac{e_0 + \sum_{j=1}^{n} e_j}{\beta} - t - c \right) - \frac{e_i}{\beta} = 0.$$

Since all private firms are identical, we have symmetric solutions $h_i = h,\ e_i = e\ (i = 1, \ldots, n)$. Applying these to the above conditions gives

$$a - c - t - h_0 - (n+1)h = 0, \tag{12}$$

$$\beta(a - t - c) - e_0 - (n + 1)e = 0. \tag{13}$$

Equations (12) and (13) represent the response functions for private firm i.

Next, consider the choice of the public firm. The optimization problem of the public firm in the second period is given by

$$\max_{h_0, e_0} \; V = \theta\pi_0 + (1 - \theta)W.$$

First, consider the choice of the tourism service in the domestic tourists' market, h_0. The first-order condition for h_0 can be written as

$$\frac{\partial V}{\partial h_0} = \theta\frac{\partial \pi_0}{\partial h_0} + (1 - \theta)\frac{\partial W}{\partial h_0} = 0. \tag{14}$$

Differentiating (6) and (9) with respect to h_0 and using (6)-(10) to obtain

$$\frac{\partial \pi_0}{\partial h_0} = a - c - t - 2h_0 - nh,$$

$$\frac{\partial W}{\partial h_0} = a - c - h_0 - nh.$$

Substituting the above two equations into (14), the first-order condition for h_0 can be written as

$$a - c - \theta t - (\theta + 1)h_0 - nh = 0. \tag{15}$$

Equation (15) represents the response function for the public firm in the domestic tourists' market. Next, consider the choice of the tourism service in the foreign tourists' market, e_0. The first-order condition for e_0 can be written as

$$\frac{\partial V}{\partial e_0} = \theta\frac{\partial \pi_0}{\partial e_0} + (1 - \theta)\frac{\partial W}{\partial e_0} = 0. \tag{16}$$

Differentiating (6) and (9) with respect to e_0 and using (6)-(10) to obtain

$$\frac{\partial \pi_0}{\partial e_0} = a - c - t - \frac{2e_0 + ne}{\beta},$$

$$\frac{\partial W}{\partial e_0} = a - c - \frac{2e_0 + 2ne}{\beta}.$$

Substituting the above two equations into equation (16), the first-order condition for e_0 can be written as

$$a - c - \theta t - \frac{2e_0 - n(\theta - 2)e}{\beta} = 0. \tag{17}$$

Equation (17) represents the response function for the public firm in the foreign tourists' market.

Equations (12), (13), (15), and (17) represent the response functions of each firm in each market. These can be solved to obtain supply functions of each tourism service for each firm. As both the domestic and foreign tourists' markets are segmented in this model, we can examine each market separately.

First, consider the domestic tourists' market. Equations (12) and (15) are the response functions of the private firm and the public firm for this market, respectively. Solving these for h and h_0 gives the supply functions of the tourism service for each firm in the domestic tourists' market.

$$h = \frac{\theta(a - c) - t}{(n + 1)\theta + 1}, \tag{18}$$

$$h_0 = \frac{a - c - t\left[(n + 1)\theta - n\right]}{(n + 1)\theta + 1}. \tag{19}$$

Comparing these, one can find

$$h_0 - h = \frac{(1 - \theta)\left[a - c + (n + 1)t\right]}{(n + 1)\theta + 1} > 0.$$

That is, the supply of the tourism service by the public firm always exceeds that by the private firm in the domestic tourists' market.

Next, consider the foreign tourists' market. Equations (13) and (17) are the response functions of the private firm and the public firm for this market, respectively. Solving these for e and e_0 gives the supply functions of the tourism service for each firm in the foreign tourists' market.

$$e = \frac{\beta\left[a - c + (\theta - 2)t\right]}{n\theta + 2}, \tag{20}$$

$$e_0 = \frac{\beta\left[(n\theta - n + 1)(a - c) + \left[2n - (2n+1)\theta\right]t\right]}{n\theta + 2}. \tag{21}$$

Again, comparing these, we have

$$e_0 - e = -\frac{\beta(1-\theta)\left[(a - c - 2t)n - 2t\right]}{n\theta + 2}.$$

Thus, in the foreign tourists' markets, the supply of the tourism service by the public firm exceeds that by the private firm provided that $(a - c - 2t)n - 2t < 0$. As in the domestic tourists' market, we assume this can hold in the subsequent analyses.

Assumption 1 : The supply of the tourism service by the public firm exceeds that by the private firm in the foreign tourists' market, $e_0 > e$. That is,

$$(a - c - 2t)n - 2t < 0.$$

3.1.2 Comparative Statics

This section examines how the amount of tourism services, the prices of tourism services, the firm's profits, and the consumer surplus can be affected by the changes in the tourism tax t, the number of firms operating in the market n, and the degree of privatization of the public firm θ. First, we consider the amount of tourism services. The effect of the tourism tax on the amount of tourism services can be obtained by differentiating equations (18)-(21) with respect to t.

$$\frac{\partial h}{\partial t} = \frac{-1}{(n+1)\theta + 1} < 0, \tag{22}$$

$$\frac{\partial h_0}{\partial t} = \frac{-(n+1)\theta + n}{(n+1)\theta + 1}, \tag{23}$$

$$\frac{\partial e}{\partial t} = \frac{\beta(\theta - 2)}{n\theta + 2} < 0, \tag{24}$$

$$\frac{\partial e_0}{\partial t} = \frac{\beta\left[2n - (2n+1)\theta\right]}{n\theta + 2}. \tag{25}$$

Thus, increasing the tourism tax rate reduces the amount of tourism service by the private firm in both markets (equations (22) and (24)), while the effects on that by the public firm are ambiguous (equations (23) and (25)). In particular, the effects on h_0 and e_0 depend on the degree of privatization of the public firm, θ. If $\theta > \frac{n}{n+1}$, an increase in t reduces h_0, and if $\theta > \frac{2n}{2n+1}$, it reduces e_0. Note that since $\frac{2n}{2n+1} - \frac{n}{n+1} = \frac{n}{(2n+1)(n+1)} > 0$, a higher θ is needed in order for e_0 to decrease in response to an increase in t relative to h_0.

The effect of the number of firms operating in the market can be obtained by differentiating equations (18)-(21) with respect to n.

$$\frac{\partial h}{\partial n} = -\frac{\left[(\theta(a-c) - t\right]\theta}{\left[(n+1)\theta + 1\right]^2} < 0, \tag{26}$$

$$\frac{\partial h_0}{\partial n} = -\frac{\theta(a-c) - t}{\left[(n+1)\theta + 1\right]^2} < 0, \tag{27}$$

$$\frac{\partial e}{\partial n} = -\frac{\beta\left[a - c + (\theta - 2)t\right]\theta}{(n\theta + 2)^2} < 0, \tag{28}$$

$$\frac{\partial e_0}{\partial n} = \frac{\beta(\theta - 2)\left[a - c + (\theta - 2)t\right]}{(n\theta + 2)^2} < 0. \tag{29}$$

Note that the signs of all the above equations are determined to be negative provided that the equilibrium amounts of all tourism services are positive. Thus, allowing entry of more firms into the market will reduce the amount of tourism services by both firms in both markets.

The effect of the degree of privatization of the public firm can be obtained by differentiating equations (18)-(21) with respect to θ.

$$\frac{\partial h}{\partial \theta} = \frac{a - c + (n+1)t}{[(n+1)\theta + 1]^2} > 0, \tag{30}$$

$$\frac{\partial h_0}{\partial \theta} = -\frac{(n+1)\,[a - c + (n+1)t]}{[(n+1)\theta + 1]^2} < 0, \tag{31}$$

$$\frac{\partial e}{\partial \theta} = -\frac{\beta\,[(a - c - 2t)n - 2t]}{(n\theta + 2)^2} > 0, \tag{32}$$

$$\frac{\partial e_0}{\partial \theta} = \frac{\beta\,[(a - c - 2t)n - 2t]\,(n+1)}{(n\theta + 2)^2} < 0. \tag{33}$$

Note that Assumption 1 is used to obtain inequalities in (32) and (33). Thus, increasing θ will raise the amount of tourism services by the private firm in both markets, while it will lower that by the public firm in both markets. In other words, increasing the degree of privatization of the public firm will raise a smaller amount of tourism service by the private firm and lower a larger amount of tourism service by the public firm.[4]

By substituting equations (18)-(21) into (4) and (5), the price of tourism services in domestic and foreign tourists' markets can be expressed, respectively, as follows.

$$p = \frac{\theta a + (n\theta + 1)c - t}{(n+1)\theta + 1}, \tag{34}$$

$$p^* = \frac{a + (n\theta + 1)c + (\theta - 2)t}{n\theta + 2}. \tag{35}$$

As in the amount, the price of tourism service is also affected by parameters such as t, n, and θ. For example, the effect of the tourism tax can be obtained by differentiating (34) and (35) with respect to t.

$$\frac{\partial p}{\partial t} = \frac{-1}{(n+1)\theta + 1} < 0, \tag{36}$$

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4 Note that e and e_0 depend on the fraction of foreign tourists β. It is clear from (20) and (21) that increasing β will raise both e and e_0.

$$\frac{\partial p^*}{\partial t} = \frac{\theta - 2}{n\theta + 2} < 0. \tag{37}$$

That is, an increase in t lowers the price of tourism services in both tourists' markets.

The effect of the number of firms operating in the market can be obtained by differentiating (34) and (35) with respect to n.

$$\frac{\partial p}{\partial n} = -\frac{\theta\left[\theta(a-c) - t\right]}{\left[(n+1)\theta + 1\right]^2} < 0, \tag{38}$$

$$\frac{\partial p^*}{\partial n} = -\frac{\theta\left[a - c + (\theta - 2)t\right]}{(n\theta + 2)^2} < 0. \tag{39}$$

That is, allowing entry of more firms lowers the price of tourism services in both markets.

The effect of the degree of privatization of the public firm can be obtained by differentiating (34) and (35) with respect to θ.

$$\frac{\partial p}{\partial \theta} = \frac{a - c + (n+1)t}{\left[(n+1)\theta + 1\right]^2} > 0, \tag{40}$$

$$\frac{\partial p^*}{\partial \theta} = -\frac{(a - c - 2t)n - 2t}{(n\theta + 2)^2} > 0. \tag{41}$$

That is, increasing θ raises the price of tourism services in both markets.

The profits of the firms can also be affected by parameters in the model. The profits can be written as $\pi = (p-c)h + (p^* - c)e$ for the private firm and $\pi_0 = (p-c)h_0 + (p^* - c)e_0$ for the public firm. The effect of the tourism tax t can be expressed as follows.

$$\frac{\partial \pi}{\partial t} = \underbrace{\left(\frac{\partial p}{\partial t} - c\right) h}_{(-)} + \underbrace{(p-c)\frac{\partial h}{\partial t}}_{(-)} + \underbrace{\left(\frac{\partial p^*}{\partial t} - c\right) e}_{(-)} + \underbrace{(p^* - c)\frac{\partial e}{\partial t}}_{(-)} < 0, \tag{42}$$

$$\frac{\partial \pi_0}{\partial t} = \underbrace{\left(\frac{\partial p}{\partial t} - c\right) h_0}_{(-)} + \underbrace{(p-c)\frac{\partial h_0}{\partial t}}_{(?)} + \underbrace{\left(\frac{\partial p^*}{\partial t} - c\right) e_0}_{(-)} + \underbrace{(p^* - c)\frac{\partial e_0}{\partial t}}_{(?)}. \tag{43}$$

The sign of (42) is negative from (22), (24), (36) and (37). That is, an increase in the tourism tax reduces the profit of the private firm. On the other hand, the sign of (43) is ambiguous as the signs of the second and fourth terms on the right-hand side are also ambiguous from (23) and (25). If θ is large enough for the signs of (23) and (25) to be negative, then the sign of (43) will be negative. However, if the θ is small enough for the signs of (23) and (25) to be positive, then an increase in the tourism tax may raise the profit of the public firm.

The effect of the number of firms operating in the market can be written as follows.

$$\frac{\partial \pi}{\partial n} = \underbrace{\left(\frac{\partial p}{\partial n} - c\right) h}_{(-)} + \underbrace{(p - c)\frac{\partial h}{\partial n}}_{(-)} + \underbrace{\left(\frac{\partial p^*}{\partial n} - c\right) e}_{(-)} + \underbrace{(p^* - c)\frac{\partial e}{\partial n}}_{(-)} < 0, \quad (44)$$

$$\frac{\partial \pi_0}{\partial n} = \underbrace{\left(\frac{\partial p}{\partial n} - c\right) h_0}_{(-)} + \underbrace{(p - c)\frac{\partial h_0}{\partial n}}_{(-)} + \underbrace{\left(\frac{\partial p^*}{\partial n} - c\right) e_0}_{(-)} + \underbrace{(p^* - c)\frac{\partial e_0}{\partial n}}_{(-)} < 0. \quad (45)$$

Inequalities in (44) and (45) follow from equations (26)-(29), (38) and (39). Thus, allowing entry of more firms into the market will decrease the profits of both firms.

The effect of the degree of privatization of the public firm can be written as follows.

$$\frac{\partial \pi}{\partial \theta} = \underbrace{\left(\frac{\partial p}{\partial \theta} - c\right) h}_{(+)} + \underbrace{(p - c)\frac{\partial h}{\partial \theta}}_{(+)} + \underbrace{\left(\frac{\partial p^*}{\partial \theta} - c\right) e}_{(+)} + \underbrace{(p^* - c)\frac{\partial e}{\partial \theta}}_{(+)} > 0, \quad (46)$$

$$\frac{\partial \pi_0}{\partial \theta} = \underbrace{\left(\frac{\partial p}{\partial \theta} - c\right) h_0}_{(+)} + \underbrace{(p - c)\frac{\partial h_0}{\partial \theta}}_{(-)} + \underbrace{\left(\frac{\partial p^*}{\partial \theta} - c\right) e_0}_{(+)} + \underbrace{(p^* - c)\frac{\partial e_0}{\partial \theta}}_{(-)}. \quad (47)$$

The sign of (46) is positive from (30), (32), (40), and (41). That is, increasing the degree of privatization of the public firm will raise the profit of the private firm. On the other hand, the sign of (47) is ambiguous. While increasing θ benefits the public firm by raising the prices of tourism services in both markets (equations (40) and (41)), it can reduce its profit by decreasing the amount of tourism services provided in both markets (equations (31) and (33)).

Finally, by substituting (18) and (19) into (8), the consumer surplus of the domestic tourists can expressed as follows.

$$CS = \frac{\left[(n\theta+1)(a-c)-(n+1)\theta t\right]^2}{2\left[(n+1)\theta+1\right]^2}. \tag{48}$$

The consumer surplus is also affected by changes in t, n, and θ. These can be obtained by differentiating (48) with respect to t, n, and θ, respectively.

$$\frac{\partial CS}{\partial t} = -\frac{\left[(n\theta+1)(a-c)-(n+1)\theta t\right](n+1)\theta}{\left[(n+1)\theta+1\right]^2} < 0, \tag{49}$$

$$\frac{\partial CS}{\partial n} = \frac{\left[(n\theta+1)(a-c)-(n+1)\theta t\right]\left[\theta(a-c)-t\right]\theta}{\left[(n+1)\theta+1\right]^3} > 0, \tag{50}$$

$$\frac{\partial CS}{\partial \theta} = -\frac{\left[(n\theta+1)(a-c)-(n+1)\theta t\right]\left[a-c+(n+1)t\right]}{\left[(n+1)\theta+1\right]^3} < 0. \tag{51}$$

Inequalities in (49)-(51) follow from the positive amount of total tourism service in the domestic tourists' market.[5] Thus, the consumer surplus will increase in response to lowering the tourism tax rate (equation (49)), increasing the number of firms operating in the market (equation (50)), and regressing the privatization of the public firm (equation (51)).

We summarize the results obtained above in the following proposition.

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[5] The total amount of x in the domestic tourists' market can be written as

$$h_0 + nh = \frac{(n\theta+1)(a-c)-(n+1)\theta t}{(n+1)\theta+1},$$

which is positive if the numerator on the right-hand side is positive.

Proposition 1 : Suppose that a country's market for a tourism service is segmented into domestic and foreign tourists, and it consists of profit-maximizing private firms and a partially-privatized public firm whose objective is to maximize a weighted sum of social welfare and its own profit. In addition, suppose that the country's government imposes a tax on the consumption of the tourism service by all tourists. Then, we have the following.

1. The amounts of tourism services by the private firm (h and e) are negatively affected by the tourism tax (t) and the number of firms operating in the market (n), and are positively affected by the degree of privatization of the public firm (θ). The amounts of tourism services by the public firm (h_0 and e_0) are negatively affected by n and θ, and can be negatively affected by t for sufficiently higher degree of privatization of the public firm.
2. The prices of tourism services in both domestic and foreign tourists' markets (p and p^*) are negatively affected by t and n, and are positively affected by θ.
3. The profit of the private firm (π) is negatively affected by t and n, and is positively affected by θ. The profit of the public firm (π_0) is negatively affected by n, and can be negatively affected by t for sufficiently higher degree of privatization of the public firm. Its effect of θ is ambiguous.
4. The domestic consumer surplus (CS) is negatively affected by t and θ, and is positively affected by n.

Proposition 1 shows that the tourism tax, the number of firms operating in the market, and the degree of privatization of the public firm could have different impacts on both firms' profits and consumers in the domestic economy. While the tourism tax hurts the private firm and the consumers, its impact on the public firm's profit is ambiguous. Increasing the number of firms operating in the market can benefit the consumers at the expense of the firm's profits. Promoting the privatization of the public firm benefits the private firm and hurts the consumers, while its impact on the public firm's profit is uncertain. How can those policies affect the domestic economy as a whole? The next section addresses this issue.

3.2 First-Period Choice of the Government

We now go back to the first period and examine the government choice of the optimal tourism tax. The government's objective is to select the tourism tax rate t to maximize the social welfare (9). That is, the government's optimization problem is formulated as follows.

$$\max_{t} \; W = CS + \pi_0 + \sum_{j=1}^{n} \pi_j + TR.$$

The first-order condition for this optimization problem can be expressed as

$$\frac{\partial W}{\partial t} = \frac{\partial CS}{\partial t} + \frac{\partial \pi_0}{\partial t} + \sum_{j=1}^{n} \frac{\partial \pi_j}{\partial t} + \frac{\partial TR}{\partial t} = 0. \tag{52}$$

Substituting (18)-(21) into (6), (7), (8), and (10), differentiating these with respect to t, and substituting into (52), the optimal tourism tax rate $\hat{t}$ can derived as

$$\hat{t} = \frac{\left\{ n\left[(n+1)\theta + 1\right]^2 \beta - (\theta n + 2)^2 \right\} (a - c)}{2(n+1)\left\{ \left[(n+1)\theta + 1\right]^2 \beta + \frac{(\theta n + 2)^2}{2} \right\}}, \tag{53}$$

which will be positive if

$$\beta > \frac{(\theta n + 2)^2}{n\left[(n+1)\theta + 1\right]^2}. \tag{54}$$

The parameter β on the left-hand side of the above inequality represents the fraction of foreign tourists, while the term on the right-hand side depends on the number of private firms n and the degree of privatization of the public firm θ. For example, if the public firm is fully nationalized ($\theta = 0$), this term reduces to $4/n$. If it is fully privatized ($\theta = 1$), it becomes $1/n$. Since $4/n > 1/n$, the condition (54) becomes relaxed when the public firm is fully privatized relative to when it is fully nationalized. In other words, as the degree of privatization of the public firm increases, the optimal tourism tax rate tends to become positive. Furthermore, as n increases, the term on the right-hand side becomes smaller and hence the condition (54) also becomes relaxed.

Taking the above arguments into consideration, it follows that if the fraction of foreign tourists β is sufficiently larger, the degree of privatization of the public firm θ is sufficiently higher, and the number of firms operating in the market n is sufficiently larger, then the optimal tourism tax rate $\hat{t}$ will be positive. In this case, the government in the host country can raise its welfare by imposing a positive tax rate on all tourists. If, on the contrary, the fraction of foreign tourists is sufficiently smaller, the degree of privatization of the public firm is sufficiently lower, or the number of firms in the market is sufficiently smaller, then the optimal tourism tax rate can be negative. In other words, the government in the host country will implement a tourism subsidy for both types of tourists.

In fact, the effect of changing parameters such as β, θ, and n can be characterized by differentiating $\hat{t}$. First, differentiating $\hat{t}$ with respect to β gives

$$\frac{\partial \hat{t}}{\partial \beta} = \frac{(n+2)\left[(n+1)\theta+1\right]^2(\theta n+2)^2(a-c)}{4(n+1)\left\{\left[(n+1)\theta+1\right]^2\beta+\frac{(\theta n+2)^2}{2}\right\}^2} > 0.$$

Thus, an increase in the fraction of foreign tourists raises the optimal tourism tax rate. In other words, for a country facing a foreign tourism boom, raising the tourism tax rate will improve its welfare.

Second, the effect of changing the degree of privatization of the public firm can be expressed by differentiating $\hat{t}$ with respect to θ.

$$\frac{\partial \hat{t}}{\partial \theta} = \frac{(n+2)^2\left[(n+1)\theta+1\right]\beta(\theta n+2)(a-c)}{2(n+1)\left\{\left[(n+1)\theta+1\right]^2\beta+\frac{(\theta n+2)^2}{2}\right\}^2} > 0.$$

Thus, as the degree of privatization of the public firm becomes higher, the optimal tourism tax rate also becomes higher. In other words, a country with a higher degree of privatization of its public firm will have a higher tourism tax rate relative to countries with a low degree of privatization of its public firm.

Third, for the effect of changing the number of firms operating in the market, we differentiate $\hat{t}$ with respect to n to obtain

$$\frac{\partial \hat{t}}{\partial n} = \frac{\Gamma \times (a-c)}{4(n+1)^2\left\{\left[(n+1)\theta+1\right]^2\beta+\frac{(\theta n+2)^2}{2}\right\}^2},$$

where

$$\begin{aligned}\Gamma = {} & 2\left[(n+1)\theta+1\right]^4\beta^2 \\ & +\left[(n+1)(n-4)\theta^2+(2n^2+15n+10)\theta+6\right]\left[(n+1)\theta+1\right](\theta n+2)\beta \\ & +(\theta n+2)^4.\end{aligned}$$

It can be confirmed that for $n > 0$, $\beta > 0$, and $\theta \in [0,1]$, we have $\Gamma > 0$ [6]. Therefore, it follows that $\partial\hat{t}/\partial n > 0$, which indicates that an increase in the number of firms in the market raises the optimal tourism tax rate.

[6] The signs of the first and third terms of Γ are positive. The sign of the second term depends on the sign of the term in square brackets, which can be re-written as

$$(\theta^2+2\theta)n^2+3\theta(5-\theta)n+4\theta\left(\frac{5}{2}-\theta\right)+6.$$

For $n > 0$ and $\theta \in [0,1]$, the sign of the above is positive. Thus, we have $\Gamma > 0$.

In other words, a country with a highly competitive domestic market for tourism services will have a higher tourism tax relative to countries with less competitive markets.

The results obtained in this section are summarized in the following proposition.

Proposition 2 : Suppose that a country's market for a tourism service is segmented into domestic and foreign tourists, and it consists of profit-maximizing private firms and a partially-privatized public firm whose objective is to maximize a weighted sum of social welfare and its own profit. In addition, suppose that the country's government imposes a tax on the consumption of the tourism service by all tourists. Then, we have the following.

1. The level of the tourism tax rate that maximizes the social welfare of the country depends on the fraction of foreign tourists (β), the degree of privatization of the public firm (θ), and the number of firms operating in the market (n), and is given by

$$\hat{t} = \frac{\left\{n\left[(n+1)\theta+1\right]^2\beta-(\theta n+2)^2\right\}(a-c)}{2(n+1)\left\{\left[(n+1)\theta+1\right]^2\beta+\frac{(\theta n+2)^2}{2}\right\}}.$$

2. The optimal tourism tax $\hat{t}$ will be positive if

$$\beta > \frac{(\theta n+2)^2}{n\left[(n+1)\theta+1\right]^2}.$$

   In other words, $\hat{t} > 0$ if β is sufficiently larger, θ is sufficiently higher, or n is sufficiently larger.
3. The optimal tourist tax $\hat{t}$ rate will become higher as (a) the fraction of foreign tourists increases, (b) the privatization of the public firm progresses, and (c) the number of firms in the market increases.

Proposition 2 is the main results of this study. According to Proposition 2, for a country facing a foreign tourism boom, promoting privatization of its public firm, or implementing a market-opening policy measured by the increase in the number of private firms, introducing or increasing the tourism tax can enhance its welfare. Or, put differently, it claims that a country facing a decline in foreign tourists, regressing privatization of its public firm, or restricting entry of more firms into its market will never benefit by introducing the tourism tax. Those are unique results of this study that analyzes the tourism tax in a model of imperfect competition, and are not present in models of perfect competition such as Hämäläinen (2004) and Gooroochurn (2009).

4.　Concluding Remarks

This study examined the optimal tourism taxes in a mixed oligopoly market in which a partially privatized public firm and private firms compete. We developed a model in which a market for a tourism service is segmented for domestic and foreign tourists, and private firms maximize their profits and a partially privatized public firm cares about the social welfare as well as its own profit. The government imposes a tourism tax on the consumption of the tourism service and selects its tax rate to maximize the social welfare. The results obtained throughout the analyses are summarized as follows.

We show that the level of the tourism tax that maximizes the social welfare depends on the fraction of foreign tourists, the degree of privatization of the public firm, and the number of firms operating in the market. In particular, for sufficiently higher fraction of foreign tourists, higher degree of privatization of the public firm, and larger number of firms in the market, the optimal tourism tax rate will be positive. Furthermore, it is shown that the optimal tourism tax rate will increase as (a) the fraction of foreign tourists increases, (b) the privatization of the public firm progresses, and (c) the number of firms in the market increases. In other words, a country facing a foreign tourism boom, with a higher degree of privatization of the public firm, and with a highly competitive domestic market for tourism services will have a higher tourism tax rate relative to countries without a tourism boom, with a lower degree of privatization of the public firm, and with less competitive markets.

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