

---

---

**論 說**

---

---

# Corporate Social Responsibility Activities in a Short-Term Closed Economy

Tadahisa Ohno

## 1. Introduction

Recently, global warming caused by greenhouse gas emissions has led to extremely important difficulties worldwide. Many firms in various fields in many countries have recently adopted policies of corporate social responsibility (CSR) and environmental corporate social responsibility (ECSR). Firms engaged in CSR activities might also act in consideration of various social aspects of the country. Firms engaged in ECSR activities might also act by their own initiative in consideration of environmental conditions in the country. Given a background similar to the current circumstances of CSR and ECSR activities by firms, many people might be interested in the effects of CSR or ECSR promotion by firms worldwide.

As described in this paper, we specifically examine CSR activities by polluting firms in countries and transboundary pollution in a closed economy in the short term. In the short term, even if firms promote CSR activities, they might not receive a positive social evaluation. The promotion of CSR activities imposes burdens on the firm from the perspective of costs of the activities. However, although the profit of the firm from CSR activities might decrease in the short term, the firm might promote CSR activities to pursue social evaluation or profits in the long term. Moreover, even if profits of the firm from CSR activities might

decrease, the firm might promote CSR activities to contribute to social profit. Recently, SDG efforts and CSR efforts have spread worldwide. Proceeding with trends of the times, firms might fall in line with other firms. That is, although firm profits might be decreased by CSR activities, firms might still promote CSR activities, thereby striving to contribute to increased consumer surplus and to decreased environmental damage.

Retail companies have corresponded to consumption of goods in a country and have supplied goods to consumers in the country. Retail companies are likely to have undertaken productive activities under a closed economy. Recently however, retail companies have active CSR. Accordingly, we analyze the promotion of CSR under a closed economy and specifically examine retail companies in the respective countries.

Theoretical studies of CSR or ECSR conducted in recent years include those reported by Wang et al. (2012), Jinji (2013), Chang et al. (2014), Lambertini and Tampieri (2015), Liu et al. (2015), Hirose et al. (2017), Ee et al. (2018), Liu et al. (2018), Lee and Park (2019), Ohno (2019), Fukuda and Ouchida (2020), Ohno (2021a), Xu et al. (2022), and others<sup>(1)</sup>. Jinji (2013) describes analyses of how corporate environmentalism in the home country affects home welfare when domestic and foreign governments impose emission taxes or provide export subsidies in an international oligopolistic market. That study demonstrates that home welfare might be lower when the home firm is environmentally conscious than when it is a profit maximizer when emission taxes and export subsidies are both available and when transboundary pollution exists. Lambertini and Tampieri (2015) use a Cournot oligopoly model to ascertain how socially responsible behavior affects firm profits and social welfare when production entails an environmental externality. They demonstrate that the CSR firm might obtain higher profits than its profit-seeking competitors and might achieve a higher level of social welfare when the market is sufficiently large. Liu

et al. (2015) use a differentiated duopoly model to assess competition structure effects on incentives for firms for adopting certified ECSR. Liu et al. (2015) demonstrate that the certifier will set a standard that is lower than the optimal standard to induce firms to adopt certified ECSR. Ee et al. (2018) use a general equilibrium framework to assess how ECSR investments affect wage inequality between skilled and unskilled workers. Liu et al. (2018) use an international oligopoly model to examine the optimal degree of CSR promotion. Although Liu et al. (2018) analyze the optimal degree of CSR promotion, they do not consider situations in which polluting firms and transboundary pollution exist. Ohno (2019) investigates whether promotion of CSR by firms improves environmental conditions in the country under circumstances that include international trade and transboundary pollution. Although Ohno (2019) examines CSR and transboundary pollution, he does not analyze CSR welfare effects. Although almost all studies of this kind examine ECSR using an oligopoly model, none evaluates a closed economy.

Theoretical studies of firm's endogenous decision-making related to CSR or ECSR in recent years include those reported by Hirose et al. (2017), Lee and Park (2019), Ohno (2021a), and Xu et al. (2022)<sup>(2)</sup>. Hirose et al. (2017) assess a model in which two firms choose whether to adopt ECSR policies and then choose their prices sequentially. Their main result is that only the follower adopts ECSR in equilibrium: a first-mover advantage is apparent. Conclusions with regard to the first-mover advantage in Hirose et al. (2017) differ from those explained by Gal-Or (1985) or by Dowrick (1986), which do not consider the ECSR in their model. Lee and Park (2019) analyze strategic interaction in the sequential adoption of ECSR of polluting firms in a duopolistic market for a situation in which eco-firms exist. Ohno (2021a) analyzes the firm's endogenous decision-making related to ECSR in each country in an open economy under situations in which, when the firm adopts ECSR, the firm's social evaluation

increases. Xu et al. (2022) examine the strategic relations between emission tax policy and ECSR in a Cournot-Bertrand comparison. Especially, Xu et al. (2022) analyze two timings of games. First, the government decides the emission tax level. Then firms determine the level of ECSR. Second, firms determine the level of ECSR. Then the government decides the emissions tax level. These studies examine the firm's endogenous decision-making related to ECSR or CSR in each country in an open economy. Nevertheless, none considers a closed economy.

Other theoretical studies of CSR and international markets in recent years include those of Wang et al. (2012) and Chang et al. (2014). Wang et al. (2012) study how consumer-friendly initiatives of foreign exporting firms affect strategic tariff policy and welfare. Chang et al. (2014) examine the welfare implications of CSR in international markets under imperfect competition. Although Wang et al. (2012) and Chang et al. (2014) analyze CSR welfare effects, they analyze no situation in which polluting firms and transboundary pollution exist in a closed economy.

This study examines how CSR promotion by a monopoly firm in each country affects environmental damage and social welfare in each country considering circumstances in which transboundary pollution exists in a short-term closed economy. Few reports of the relevant literature describe studies of CSR particularly addressing a closed economy. Moreover, this study examines a CSR firm that not only pursues profits but which also monitors environmental damage in the country and which is sensitive to consumer surplus in the country. Earlier CSR-firm-related research that considers both consumer surplus in a country and environmental damage in a country is scarce<sup>(3)</sup>. Moreover, we present examination of how a higher amount of transboundary pollution affects environmental damage and social welfare in one or more countries under the same circumstances.

Results of these analyses indicate the following main conclusions. First, if the

degree of marginal environmental damage is small (large) when the level of CSR in each country is high, then the equilibrium environmental damage in each country greater (lesser). Secondly, whether the degree of marginal environmental damage is small or large, when the level of CSR in each country is high, the equilibrium social welfare in each country is great. Thirdly, when the firm in each country chooses the same degree of CSR, if the degree of transboundary pollution is large, then the equilibrium social welfare in each country is great.

From these findings obtained through this study, the following can be inferred. First, when the degree of marginal environmental damage is large, a retail company's CSR activities will lessen the environmental damage in its country. Secondly, irrespective of the degree of marginal environmental damage, a retail company's CSR activities will raise the social welfare in its country.

## 2. Model

We evaluate a world with two homogeneous countries: country 1 and country 2, each with homogeneous residents and a single firm. Residents of each country are standardized to one unit. Furthermore, migration does not occur between the two countries because short-term economic conditions are assumed. Each firm produces a private good. Moreover, each resident demands the private good. Production of the good creates environmental pollution. The respective firms' emissions have transboundary spillovers. The inverse demand functions for the good of country  $i$  are assumed as shown below.

$$P_i = a - q_i \quad (1)$$

Therein, term  $P_i$  denotes the market price of country  $i$ . Term  $a$  denotes the willingness to pay for a good ( $a > 0$ ). Term  $q_i$  expresses the demand for the good in country  $i$ . Under this inverse demand function, the consumer surplus in country  $i$  is

$$CS_i = \frac{1}{2}q_i^2. \quad (2)$$

This report describes analyses based on the assumption that the marginal cost of the firm in country  $i$  to supply the private good equals  $c$ . These marginal cost values in both countries are equal. The cost function of the firm in country  $i$  is  $C(q_i) = cq_i$ . The analyses presented in this paper are conducted based on the assumption that if the output of the firm in country  $i$  is  $q_i$ , then emissions in country  $i$  are  $q_i$ . Moreover, we analyze the promotion of CSR under situations in which transboundary pollution exists. The degree of emissions as transboundary pollution is denoted as  $\lambda$ . We assume that  $0 \leq \lambda \leq 1$ . Consequently, the total quantity of emissions in country  $i$  is

$$s_i = (1 - \lambda)q_i + \lambda q_j. \quad (3)$$

In eq. (3), term  $s_i$  represents the total quantity of emissions in country  $i$ . The extent of the environmental damage in country  $i$  is assumed as

$$D_i(q_i, q_j) = \alpha s_i = \alpha \{(1 - \lambda)q_i + \lambda q_j\}. \quad (4)$$

Here,  $\alpha$  represents the degree of marginal environmental damage which occurs because of production of the goods. Furthermore,  $\alpha$  is the same in both countries.

The firm profit in country  $i$  is obtained as  $\pi_i = P_i q_i - cq_i$ . From eq. (1), the profit of the firm in country  $i$  from producing the good is

$$\pi_i = Aq_i - q_i^2. \quad (5)$$

For this analysis, we assume that  $A \equiv a - c (> 0)$ . Moreover, we assume that parameter  $A$  is large.

We assume that the firm pursues profits, but that the firm also conducts its activities considering various social matters prevailing in the country. Therefore, we assume that the firm pursues profits, but that the firm also acts specifically in consideration of the expected outcomes of consumer surplus and environmental damage in the country. The firm in country  $i$  strives to maximize its objective function, as shown below<sup>(4)</sup>.

$$V_i = \pi_i + k_i(CS_i - D_i) \quad (6)$$

Here,  $k_i$  represents the degree of CSR of the firm in country  $i$  based on the assumption that  $0 \leq k_i \leq 1$ .

The social welfare level in country  $i$  is defined as

$$SW_i = \pi_i + CS_i - D_i. \quad (7)$$

After analyzing the firm's choice of the level of output to maximize their own firm's objective function, we apply comparative static analysis of the output at equilibrium. The analysis reveals how CSR promotion activities and production by a monopoly firm in each country affects the environmental damage and social welfare in each country. Furthermore, we analyze how a higher degree of transboundary pollution affects environmental damage and social welfare in each country.

### 3. Decision of the Polluting Firm and CSR

The firm in country  $i$  determines the output of the good to maximize the firm's objective function  $V_i$ .

The first-order condition can be derived as presented below.

$$k_i \frac{dCS_i}{dq_i} + \frac{dTR_i}{dq_i} = c + k_i \frac{dD_i}{dq_i} \quad (8)$$

Here, the total revenue of the firm in country  $i$  is  $TR_i$  ( $TR_i \equiv (a - q_i)q_i$ ).

Actually, eq. (8) is the condition under which the marginal benefit from the good equals the marginal cost from production of the good in country  $i$ . The firm in country  $i$  determines the output of the good to satisfy eq. (8).

From eq. (8), the level of output in country  $i$  at equilibrium is the following<sup>(5)</sup>.

$$q_i^* = \frac{A - k_i\alpha(1 - \lambda)}{2 - k_i} \quad (9)$$

Here, the output of the good in country  $i$  is presented as  $q_i^*$ .

Comparative static analysis of the output of equilibrium to the degree of CSR in country  $i$  can be expressed as the following.

$$\frac{dq_i^*}{dk_i} = \frac{A - 2\alpha(1 - \lambda)}{(2 - k_i)^2} \quad (10)$$

From eq. (10), the following lemma can be obtained.

**Lemma 1**

- (1) *If  $\frac{A}{2(1-\lambda)} > \alpha$ , then a higher level of CSR is expected from a greater amount of output of the good in country  $i$  at equilibrium.*
- (2) *If  $\frac{A}{2(1-\lambda)} = \alpha$ , then promotion of CSR is not expected to affect the amount of output of the good in country  $i$  at equilibrium.*
- (3) *If  $\frac{A}{2(1-\lambda)} < \alpha$ , then a higher level of CSR is expected from a smaller amount of output of the good in country  $i$  at equilibrium.*

The interpretation of Lemma 1 (1) is the following. A large degree of CSR activity leads to greater marginal consumer's surplus and greater marginal environmental damage in the country. Here, when the degree of marginal environmental damage is small ( $\frac{A}{2(1-\lambda)} > \alpha$ ), the increase of marginal consumer's surplus is expected to be greater than the increase of marginal environmental damage. Accordingly, if  $\frac{A}{2(1-\lambda)} > \alpha$  when the degree of CSR is large, then the equilibrium output in the country is expected to be greater.

The interpretation of Lemma 1 (2) is the following. If  $\frac{A}{2(1-\lambda)} = \alpha$ , then the increase of marginal consumer's surplus is expected to be equal to the increase of the marginal environmental damage.

The interpretation of Lemma 1 (3) is the following. A large degree of CSR is expected to lead to greater marginal consumer's surplus and greater marginal environmental damage in the country. Here, when the degree of marginal environmental damage is large ( $\frac{A}{2(1-\lambda)} < \alpha$ ), the increase of marginal

consumer's surplus is smaller than the increase of marginal environmental damage. Accordingly, if  $\frac{A}{2(1-\lambda)} < \alpha$  when the degree of CSR is large, then the equilibrium output in the country is expected to become less.

After inserting eq. (9) into eq. (4), eq. (4) is given as presented below.

$$D_i^* = \alpha \left\{ (1 - \lambda) \frac{A - k_i \alpha (1 - \lambda)}{2 - k_i} + \lambda \frac{A - k_j \alpha (1 - \lambda)}{2 - k_j} \right\} \quad (11)$$

Here, the equilibrium environmental damage in country  $i$  is expressed as  $D_i^*$ .

With regard to the equilibrium environmental damage in country  $i$  (eq. (11)), the results of comparative static analyses by the degree of CSR in country  $i$  are the following.

$$\frac{dD_i^*}{dk_i} = \frac{\alpha(1 - \lambda)\{A - 2\alpha(1 - \lambda)\}}{(2 - k_i)^2} \quad (12)$$

Results of comparative static analyses applied to the equilibrium environmental damage to the degree of CSR in each country indicate the following proposition.

**Proposition 1**

- (1) If  $\frac{A}{2(1-\lambda)} > \alpha$ , then a higher level of CSR activities in country  $i$  leads to a greater amount of environmental damage in country  $i$  at equilibrium.
- (2) If  $\frac{A}{2(1-\lambda)} = \alpha$ , then promotion of CSR activities in country  $i$  does not affect the amount of environmental damage in country  $i$  at equilibrium.
- (3) If  $\frac{A}{2(1-\lambda)} < \alpha$ , then a higher level of CSR activities in country  $i$ , leads to a smaller amount of environmental damage in country  $i$  at equilibrium.

The interpretation of proposition 1 (1) is presented hereinafter. From Lemma 1 (1), if the degree of marginal environmental damage is slight as  $\left(\frac{A}{2(1-\lambda)} > \alpha\right)$ , then when the degree of CSR in country  $i$  is large, the equilibrium output in country  $i$  is expected to be greater. Accordingly, if  $\frac{A}{2(1-\lambda)} > \alpha$  when the degree of CSR in country  $i$  is large, then the equilibrium environmental damage in country  $i$

is greater.

The interpretation of proposition 1 (2) is the following. From Lemma 1 (2), if  $\frac{A}{2(1-\lambda)} = \alpha$ , then promotion of CSR does not affect the amount of output of the good in country  $i$  at equilibrium. Accordingly, if  $\frac{A}{2(1-\lambda)} = \alpha$ , then promotion of CSR in country  $i$  does not affect environmental damage in country  $i$  at equilibrium.

The interpretation of proposition 1 (3) is the following. From Lemma 1 (3), if the degree of marginal environmental damage is large ( $\frac{A}{2(1-\lambda)} < \alpha$ ) when the degree of CSR in country  $i$  is large, then the equilibrium output in country  $i$  is expected to be less. Accordingly, if  $\frac{A}{2(1-\lambda)} < \alpha$  when the degree of CSR in country  $i$  is large, then the equilibrium environmental damage in country  $i$  is less.

From eq. (9), when the degree of transboundary pollution is large, the equilibrium output in country  $i$  is higher. The interpretation of this result is the following. When the degree of transboundary pollution is large, the marginal environmental damage in country  $i$  is lesser. Consequently, when the degree of transboundary pollution is large, the equilibrium output in country  $i$  is greater.

After inserting eq. (9) into eq. (5), eq. (5) is given as presented below.

$$\pi_i^* = A \left\{ \frac{A - k_i \alpha (1 - \lambda)}{2 - k_i} \right\} - \left\{ \frac{A - k_i \alpha (1 - \lambda)}{2 - k_i} \right\}^2 \quad (13)$$

Here, the equilibrium profit of the firm in country  $i$  is expressed as  $\pi_i^*$ .

With regard to the equilibrium profit of the firm in country  $i$  (eq.(13)), the results of comparative static analyses by the degree of CSR in country  $i$  are the following.

$$\frac{d\pi_i^*}{dk_i} = \frac{\{-Ak_i + 2k_i\alpha(1-\lambda)\}\{A - 2\alpha(1-\lambda)\}}{(2 - k_i)^3} < 0 \quad (14)$$

A higher level of CSR in country  $i$  is expected to lead to smaller profits of the firm in country  $i$  at equilibrium. If the firm maximizes the profit only, then the firm has no incentive to adopt CSR. However, we have described that the firm

## Corporate Social Responsibility Activities in a Short-Term Closed Economy

not only pursues profits; it also monitors environmental damage in the country. It is sensitive to consumer surplus in the country. The firm in country  $i$  strives to maximize the objective function eq. (6). The model setting of CSR in the objective function is the same as that described by Ohno (2021b). Ohno (2021b) analyzes the firm's endogenous decision-making related to the CSR in each country in an open economy under situations in which, even if the firm adopts CSR, the firm's social evaluation does not increase. Ohno (2021b) demonstrates that the firm in each country adopts CSR at equilibrium. Consequently, the firm which maximizes these like the objective function might have an incentive to adopt CSR because the firm considers not only environmental damage but also the consumer surplus. Another perspective is the following. As described herein, we consider the short-term economy. Although the profit of the firm from CSR activities might decrease in the short term, the firm might promote CSR activities to pursue a better social evaluation or long-term profit. Moreover, even if the profit of the firm from CSR activities might decrease, the firm might promote CSR activities to contribute to social profits.

Comparative statics assessing the equilibrium environmental damage in country  $i$  and the degree of transboundary pollution indicates the following.

$$\frac{dD_i^*}{d\lambda} = \alpha(q_j^* - q_i^*) + \alpha(1 - \lambda)\frac{dq_i^*}{d\lambda} + \alpha\lambda\frac{dq_j^*}{d\lambda} \quad (15)$$

In eq. (15), the first term denotes the direct effects of an increase of transboundary pollution. The second term represents the indirect effects of an increase of transboundary pollution through the increase of equilibrium output in country  $i$  from the increase of transboundary pollution. The third term stands for indirect effects of the increase of transboundary pollution through the increase of equilibrium output in country  $j$  from the increase of transboundary pollution.

Our model includes the assumption of a symmetric country. Therefore, we assume that the firm in each country chooses the same degree of CSR, and that

the degree of CSR in each country is of the same level ( $k_1 = k_2 = k$ ). Under this assumption, eq. (15) is calculated as the following.

$$\frac{dD_i^*}{d\lambda} = \frac{\alpha^2 k(2-k)}{(2-k)^2} > 0 \quad (16)$$

From eq. (16), one can obtain the following proposition.

### **Proposition 2**

*When the firm in each country chooses the same degree of CSR, the larger the degree of transboundary pollution becomes, the greater the amount of environmental damage which is expected to occur in country  $i$  at equilibrium.*

The interpretation of proposition 2 is the following. When the firm in each country chooses the same degree of CSR, the equilibrium output in each country will be the same quantity. Consequently, in eq. (15), the direct effects of increased transboundary pollution mutually cancel. The first term of eq. (15) is zero. Consequently, when the firm in each country chooses the same degree of CSR, only the indirect effects of the increase of transboundary pollution exist. In eq. (15), the signs of both the indirect effects of the second term and the indirect effects of the third term are positive. Accordingly, when the firm in each country chooses the same degree of CSR, the greater the degree of transboundary pollution becomes, the greater is the environmental damage in country  $i$  at equilibrium.

## **4. CSR, Transboundary Pollution, and Social Welfare**

This section presents analyses of how the firm's promotion of CSR in each country affects the equilibrium level of social welfare in each country. Furthermore, we analyze how the higher degree of transboundary pollution affects the level of social welfare in each country.

From eq. (7), the first derivative of equilibrium social welfare in country  $i$  with respect to  $k_i$  is derived as

$$\frac{dSW_i^*}{dk_i} = \{A - q_i^* - \alpha(1 - \lambda)\} \frac{dq_i^*}{dk_i}. \quad (17)$$

Consequently, after inserting eq. (9) into eq. (17), one obtains

$$\frac{dSW_i^*}{dk_i} = \left[ \frac{(1 - k_i)\{A - 2\alpha(1 - \lambda)\}}{2 - k_i} \right] \frac{dq_i^*}{dk_i}. \quad (18)$$

From lemma 1, if  $\frac{A}{2(1-\lambda)} \geq \alpha$ , then  $dq_i^*/dk_i \geq 0$  is realized. Therefore, one can obtain the following relation from eq. (18).

$$\text{if } \frac{A}{2(1-\lambda)} \geq \alpha \Rightarrow \frac{dSW_i^*}{dk_i} \geq 0$$

From lemma 1, if  $\frac{A}{2(1-\lambda)} < \alpha$ , then  $dq_i^*/dk_i < 0$  is realized. Therefore, one can obtain the following relation from eq. (18).

$$\text{if } \frac{A}{2(1-\lambda)} < \alpha \Rightarrow \frac{dSW_i^*}{dk_i} > 0$$

One can infer the following conclusion.

**Proposition 3**

- (1) *If  $\frac{A}{2(1-\lambda)} > \alpha$ , then a greater amount of CSR activities conducted in country  $i$  will lead to a higher level of social welfare achieved in country  $i$  at equilibrium.*
- (2) *If  $\frac{A}{2(1-\lambda)} = \alpha$ , then promotion of CSR in country  $i$  does not affect the level of social welfare in country  $i$  at equilibrium.*
- (3) *If  $\frac{A}{2(1-\lambda)} < \alpha$ , then a greater amount of CSR activities conducted in country  $i$  will lead to a higher level of social welfare achieved in country  $i$  at equilibrium.*

The interpretation of proposition 3(1) is the following. From Lemma 1(1), if the degree of marginal environmental damage is small ( $\frac{A}{2(1-\lambda)} > \alpha$ ) when

the degree of CSR in country  $i$  is large, then the equilibrium output in country  $i$  is expected to increase. When the equilibrium output of the good in country  $i$  increases, then the consumer surplus and total revenues of the firm in country  $i$  are expected to increase. However, when the equilibrium output of the good in country  $i$  increases, environmental damage and the firm's production cost of the good in country  $i$  are expected to increase. The effects of increased environmental damage are expected to be weaker if the degree of marginal environmental damage is small. Consequently, the effects of increased consumer surplus and total revenue of the firm are greater than the effects of increased environmental damage and firm's production costs of the good in country  $i$ . Accordingly, when the degree of marginal environmental damage is small ( $\frac{A}{2(1-\lambda)} > a$ ), the promotion of CSR in country  $i$  is expected to raise the level of social welfare in country  $i$ .

The interpretation of proposition 3(3) is the following. From Lemma 1(3), if the degree of marginal environmental damage is large ( $\frac{A}{2(1-\lambda)} < a$ ) when the degree of CSR in country  $i$  is large, then the equilibrium output in country  $i$  is expected to decrease. When the equilibrium output of the good in country  $i$  decreases, then the consumer surplus and total revenues of the firm in country  $i$  is expected to decrease. However, when the equilibrium output of the good in country  $i$  decreases, environmental damage and the firm's production cost of the good in country  $i$  are expected to decrease. The effects of a decrease of environmental damage are expected to be stronger if the degree of marginal environmental damage is large. Consequently, the effects of a decrease of environmental damage and the firm's production costs of the good are expected to be greater than the effects of the decrease of consumer surplus and total revenues of the firm. Accordingly, when the degree of marginal environmental damage is large ( $\frac{A}{2(1-\lambda)} < a$ ), the promotion of CSR in country  $i$  is expected to raise the level of social welfare in country  $i$ .

Next, we analyze how transboundary pollution affects the equilibrium level of

social welfare in country  $i$ .

$$\frac{dSW_i^*}{d\lambda} = \frac{k\alpha\{\alpha k(2-k) + A(1-k) - 2\alpha\}}{(2-k)^2} > 0 \quad (19)$$

From the assumption that parameter  $A$  is large, we assume that the sign of the numerator of eq. (19) is positive. Accordingly, one obtains the following proposition.

**Proposition 4**

*If the firm in each country chooses the same degree of CSR when the degree of transboundary pollution is large, then the equilibrium level of social welfare in country  $i$  increases.*

The interpretation of proposition 4 is the following. When the degree of transboundary pollution is large, the equilibrium output in country  $i$  increases. When the equilibrium output of the good in country  $i$  increases, the consumer surplus and the total revenues of the firm in country  $i$  are expected to increase. However, when the equilibrium output of the good in country  $i$  increases, the level of equilibrium environmental damage and the firm's production cost of the good in country  $i$  are expected to increase. Here, the effects of increased consumer surplus and the total revenues of the firm in country  $i$  are greater than the effects of the increase of environmental damage and the firm's production costs of the good in country  $i$ . Accordingly, when the degree of transboundary pollution is large, the equilibrium level of social welfare in country  $i$  is expected to increase.

## 5. Concluding Remarks

We analyzed how promotion of CSR by a polluting firm in each country can be expected to affect the amounts of social welfare and environmental damage in the

respective countries under circumstances in which transboundary pollution exists in a closed economy. These analyses indicate the following main conclusions. First, if the degree of marginal environmental damage is large when the level of CSR in each country is high, then the equilibrium environmental damage in each country can be expected to decrease. Second, whether the degree of marginal environmental damage is small or large, when the level of CSR in each country is high, the equilibrium level of social welfare in each country can be expected to increase. Third, when the firm in each country chooses the same degree of CSR, if the degree of transboundary pollution is large, then the equilibrium social welfare in each country can be expected to increase. From these results of this study, the following inferences can be made. First, when the degree of marginal environmental damage is large, a retail company's CSR activities will decrease the environmental damage in its country. Secondly, irrespective of the degree of marginal environmental damage, a retail company's CSR activities will raise the level of social welfare in its country. Accordingly, promotion of the firm's CSR activities will be able to improve both the environmental conditions in its country and the social welfare in its country.

As described in this paper, we examine the CSR activities in each country, particularly addressing the short-term economy. Consequently, irrespective of whether the firm's CSR activities decrease firm profits, we examine how promotion of CSR in each country affects the levels of social welfare. Accordingly, future studies will be undertaken to examine aspects of environmental policy to model situations in which the firm's CSR activities increase profits and provide incentives for the promotion of CSR in the long-term economy.

This paper specifically presents consideration of a world with homogeneous countries. To realize a more general model, the problem examined in this paper must be analyzed under circumstances in which the degrees of marginal environmental damage differ among countries.

## Corporate Social Responsibility Activities in a Short-Term Closed Economy

## 【注】

- (1) Yanase (2012), Matsumura and Ogawa (2014, 2016), Lambertini et al. (2016) present further details of studies on CSR.
- (2) Other theoretical studies include the following. Ohno (2020) analyzes the firm's endogenous decision-making related to ECSR in each country in an open economy under situations in which transboundary pollution exists or does not exist. In a later study, Ohno (2021b) analyzes the firm's endogenous decision-making related to CSR in each country in an open economy. Ohno (2021b) considers a CSR firm that not only pursues profits but which also monitors environmental damage in the country and which is sensitive to consumer surplus in the country.
- (3) Fukuda and Ouchida (2020) analyze effects of a firm's CSR behavior on economic welfare and the environment under a time-consistent emission tax in a monopoly market. In their model, a CSR firm considers both consumer surplus in the country and environmental damage in the country.  
Lambertini and Tampieri (2015) also consider a CSR firm that incorporates consumer surplus and environmental damage in the objective function in their model.
- (4) The model setting of CSR in the objective function is similar to that described by Fukuda and Ouchida (2020).
- (5) From the assumption that parameter  $A$  is large, the sign of eq. (9) is positive.

## References

- [1] Chang, Y.M., Chen, H.Y., Wang, L.F.S. and Wu, S.J. (2014) "Corporate Social Responsibility and International Competition: A Welfare Analysis," *Review of International Economics*, 22(3), 625–638.
- [2] Dowrick, S. (1986) "von Stackelberg and Cournot duopoly: Choosing roles," *Rand Journal of Economics*, 17(2), 251–260.
- [3] Ee, M.S., Chao, C.-C., Wang, L.F.S. and Yu, E.S.H. (2018) "Environmental corporate social responsibility, firm dynamics and wage inequality," *International Review of Economics and Finance*, 56, 63–74.
- [4] Fukuda, K. and Ouchida, Y. (2020) "Corporate social responsibility (CSR) and the environment: Does CSR increase emissions?," *Energy Economics*, 92, 104933.
- [5] Gal-Or, E. (1985) "First mover and second mover advantages," *International Economic Review*, 26(3), 649–653.

- [ 6 ] Hirose, K., Lee, S.H. and Matsumura, T. (2017) “Environmental corporate social responsibility: A note on the first-mover advantage under price competition,” *Economics Bulletin*, 37(1), 214-221.
- [ 7 ] Jinji, N. (2013) “Is Corporate Environmentalism Good for Domestic Welfare?,” *Review of International Economics*, 21(5), 901-911.
- [ 8 ] Lambertini, L. and Tampieri, A. (2015) “Incentives, performance and desirability of socially responsible firms in a Cournot oligopoly,” *Economic Modelling*, 50, 40-48.
- [ 9 ] Lambertini, L., Palestini, A. and Tampieri, A. (2016) “CSR in an Asymmetric Duopoly with Environmental Externality,” *Southern Economic Journal*, vol. 83(1), 236-252.
- [10] Lee, S.H. and Park, C.H. (2019) “Eco-Firms and Sequential Adoption of Environmental Corporate Social Responsibility in the Managerial Delegation,” *The B. E. Journal of Theoretical Economics*, 19(1), 1-9.
- [11] Liu, C.C., Wang, L.F.S. and Lee, S.H. (2015) “Strategic environmental corporate social responsibility in a differentiated duopoly market,” *Economics Letters*, 129, 108-111.
- [12] Liu, Q., Wang, L.F.S. and Chen, C.L. (2018) “CSR in an oligopoly with foreign competition: Policy and welfare implications,” *Economic Modelling*, 72, 1-7.
- [13] Matsumura, T. and Ogawa, A. (2014) “Corporate Social Responsibility or Payoff Asymmetry? A Study of an Endogenous Timing Game,” *Southern Economic Journal*, 81(2), 457-473.
- [14] Matsumura, T. and Ogawa, A. (2016) “Corporate social responsibility and endogenous competition structure,” *Economics Bulletin*, 36(4), 2117-2127.
- [15] Ohno, T. (2019) “Transboundary Pollution and Environmental Corporate Social Responsibility in an Open Economy,” *Kumamoto Law Review*, 147, 241-256.
- [16] Ohno, T. (2020) “Transboundary Pollution and Endogenous Decision-Making about Environmental Corporate Social Responsibility,” *Kumamoto Law Review*, 149, 105-120.
- [17] Ohno, T. (2021a) “Environmental Corporate Social Responsibility and the Social Evaluation in an Open Economy,” *Kumamoto Law Review*, 152, 83-104. (in Japanese)
- [18] Ohno, T. (2021b) “A Note on Endogenous Decision-Making about CSR Activities,” *Kumamoto Law Review*, 153, 110-128. (in Japanese)
- [19] Wang, L.F.S., Wang, Y.C. and Zhao, L. (2012) “Tariff policy and welfare in an international duopoly with consumer-friendly initiative,” *Bulletin of Economic*

Corporate Social Responsibility Activities in a Short-Term Closed Economy

*Research*, 64(1) 56–64.

- [20] Xu, L., Chen, Y. and Lee, S.H. (2022) “Emission tax and strategic environmental corporate social responsibility in a Cournot–Bertrand comparison,” *Energy Economics*, 107, 105846.
- [21] Yanase, A. (2012) “Trade and Global Pollution in Dynamic Oligopoly with Corporate Environmentalism,” *Review of International Economics*, 20(5), 924–943.