Should State Trading Enterprises in an Exporting Country be Privatized?

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Abstract

This paper studies the privatization of an exporting state trading enterprise (STE). Adopting the mixed oligopoly approach, we analyze whether the privatization of the exporting STE responsible for procurement and exports increases both domestic and foreign welfare. The STE is assumed to maximize biased welfare inclining slightly toward domestic producers' profits and to compete against foreign producers in the foreign market à la Cournot competition. We find that privatization can deteriorate the domestic welfare even if the STE's profits are negative before privatization. Moreover, it is shown that privatization can also be a beggar-thy-neighbor policy.

1 Introduction

The purpose of this paper is to present a theoretical analysis of effect of the privatization of an exporting state trading enterprise (STE) with respect to both domestic and foreign social welfare. More precisely, we consider the situation where an exporting STE engages in the domestic procurement and exports to a foreign country to protect the domestic producers.

STEs are common and popular in developed, developing, and former communist transitional economies.[1] However, fewer efforts have been made to study the existence and effects of STEs in the context of international trade.[2] Lloyd (1982) and Ackerman and Dixit (1998) derived the condition on the tariff equivalent of STEs. Then, taking into account that the above two papers did not discuss the size of trade distorting effect, McCorriston and MacLaren (2005a) paid attention to the bestowing of exclusive rights to the STEs, and found that it strikingly depends on the trade distorting impact. Although Lloyd (1982), Ackerman and Dixit (1998), and McCorriston and MacLaren (2005a) considered importing STEs, there exist only few works on exporting STEs.[3] Alston and Gray (2000) considered the welfare effect of the exporting STE located in a small country, using an example of the Canadian Wheat Board (CWB), and they showed that CWB behaves similar to an export subsidy.[4] Furthermore, McCorriston and MacLaren (2005b, 2007a) considered a model with an exporting STE similar to the one in McCorriston and MacLaren (2005a), and investigated the trade distorting effect, allowing for the difference in the nature of

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[1]The definition of an STE is given in WTO (1995). Moreover, for a detailed discussion on the STEs involved in the trade of goods, specifically, agricultural products, see McCorriston and MacLaren (2005a).

[2]Note that though there are a few works on STEs, the potential trade distorting effect of STEs has been covered since long by researchers. As one of the oldest works in this field, see Meade (1955).

[3]Most recently, McCorriston and MacLaren (2008) showed that the existence of an importing STE distorts international trade by restricting market access relative to a Cournot benchmark, using the data of the Korean rice market.

[4]Hamilton and Stiegert (2000) analyzed the antitrust implication of the vertical relation between upstream firms with price restraint and downstream firms corresponding to an STE. Subsequently, Hamilton and Stiegert (2002) empirically examined the merit for the government to utilize a rent-shifting mechanism through STEs, applying the data of the CWB.

the STE's payoff function. This paper is on the lines of the above works on an exporting STE, and we provide a rigorous theoretical analysis on the privatization of the STE. In particular, we attempt to give a theoretical consequence against the problem of how the degree of the protection accorded to domestic producers and the privatization of the exporting STE influence both the domestic social welfare and foreign social welfare. In recent years, the Australian Wheat Board (AWB) has been privatized.[5] Is such privatization successful and effective from the viewpoint of the domestic country? Does not the privatization policy harm the foreign countries' interests? These questions are significant and should be resolved. For this purpose, in this paper, we use *mixed oligopoly* where privatization of the state-owned enterprise is a central issue, and try to give an answer to the above questions.

In the literature on mixed oligopoly, it is usually assumed that state-owned welfare-maximizing public firms compete against profit-maximizing private firms. The modern theoretical work on mixed oligopoly can be traced back to DeFraja and Delbono (1989). Although the works on mixed oligopoly since the paper of DeFraja and Delbono (1989) tackled many issues such as environmental policies and each firm's R&D investment, in particular, the number of works on the international trade has been increasing recently.[6] Fjell and Pal (1996), Pal and White (1998), and Fjell and Heywood (2002) first considered foreign private competitors in the context of mixed oligopoly.[7] However, all of the above papers assumed that there exists a corresponding market in the domestic country, and thus, the foreign private engages only in exports to the domestic country containing one public firm and several private firms. More recently, Bárcena-Ruiz and

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[5]As indicated in McCorriston and MacLaren (2007b), the privatization of the AWB began in 1999, and one of its two classes of shares was floated in 2001.

[6]Bárcena-Ruiz and Garzón (2006), Kato (2006), and Ohori (2006) explored the optimal environmental tax levels, and the effects of allowing both trade permits and privatization in a mixed industry. Further, Matsumura and Matsushima (2004) and Ishibashi and Matsumura (2006) considered the R&D investments of both the public firm and the private firm in a mixed duopoly, and tried to explain the cost differentials between public and private firms.

[7]Note that Fjell and Pal (1996), Pal and White (1998), and Fjell and Heywood (2002) did not take into account the presence of public firms located in the foreign country.

Garzón (2005a) and Dadpay and Heywood (2006) adopted the integrated market hypothesis and considered the situation wherein each of the two countries has one public firm. In their papers, the effectiveness of the privatization of the public firms located in both the countries was investigated in terms of both the equilibrium social welfare in each country and total social welfare.[8] Similar to the above literature on mixed oligopoly, in this paper, we evaluate the effect of the privatization of an exporting STE by comparing the equilibrium social welfare before and after its privatization. Since, as described above, the main role of the exporting STE is to protect the domestic producers, in this paper, we assume that the STE seeks to maximize not simple welfare, which is defined as the sum of the consumers' and the producer's surplus, but welfare inclining slightly toward the domestic producer. Specifically, we parameterize the degree of protection accorded to the domestic producers that is attached to the domestic producers' profits in welfare. This parameterization allows us to investigate the effects of producer-favoring policies not only on the behaviors of the STE but also on domestic and foreign welfare. It also allows us to consider the influence of the parameter on the effectiveness of the privatization of the STE.[9] Furthermore, in the real world, the government and the public enterprises tend to act like protecting some industries, in particular, those in the agricultural sector using various policies such as subsidies, supporting prices, and bestowing some priority or rights to producers. These policies are frequently applied

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[8]Bárcena-Ruiz and Garzón (2005b) and Tomaru and Nakamura (2008) focused on the vertical structures of governments. More precisely, Bárcena-Ruiz and Garzón (2005b) supposed the situation that there exists a supra-national authority such as the commission among EU governments, and analyzed the problem of whether it should be national governments that decide whether to privatize public firms or whether this decision should be delegated to a supra-national authority in an open market involving two countries. Tomaru and Nakamura (2008) considered a mixed oligopoly model composed of two regions where the public firms owned not only by the local governments in the respective regions but also by the central government can coexist and compete with the private firms.

[9]As in White (2002) on mixed oligopoly with a public firm that maximizes *generalized social welfare* given by the weighted sum of consumer and producer surplus, McCorriston and MacLaren (2005, 2007a, 2007b, 2008) assumed that the STE maximizes a function with the weighted sum of consumer and producer surplus, and its profit. However, since they specified the values of the weights in the STE's objective function in several ways, they cannot explicitly consider the attitudes of the STE through its objective function. Therefore, we allow for continuous change in the attitude of the exporting STE in protecting the domestic producers and provide a theoretical analysis of whether the privatization of the STE increases/decreases both domestic and foreign welfare, even though the objective function of the STE which is adopted in this paper is more simple than the one in McCorriston and MacLaren (2007a).

to guarantee the minimum living standard of producers and secure sufficient consumption in the domestic countries. Moreover, they are also applied by politicians even to secure enough votes for re-elections because particular sectors are big sources of votes. Then we incorporate such a propensity of protection by the public authorities into the model.

Again, we endeavor to examine the impacts of the privatization of the STE on domestic and foreign welfare given that the STE favors domestic producers. Then, we employ the model wherein there is one profit-maximizing producer each is located in both the domestic and foreign countries, and there exists an STE in the domestic country that bears all responsibility to procure and export domestic products. In particular, the STE procures the good from the domestic producer and sells it to both domestic and foreign consumers. Different from the previous studies on STEs and mixed oligopoly, the STE as a public enterprise and the foreign producer engage in Cournot competition not in the domestic country but in the foreign country. In such a setting, the behavior of the STE and privatization inevitably influence the foreign country's demand and welfare.

We find that privatization improves the domestic welfare only if the STE runs at a loss and that the reverse does not always hold. In some cases of privatization, it is proved empirically that inefficiency of public enterprises, such as in technological aspects the inefficient usage of some resources and X-inefficiency, impedes normal profits. On the basis of this evidence, many politicians and industrialists and even some economists advocate that such public enterprises running at a loss should be privatized, thereby giving them incentives to gain profits and thereby improve welfare improvement. However, our results demonstrate that such statements are merely a cock-and-bull story. Furthermore, we also find that privatization is desirable for both domestic and foreign countries when protection by the STE is not so strong, whereas privatization would be a beggar-thy-neighbor policy when the STE overly protects the domestic producer. Provided that privatization of the STE in one country is a beggar-thy-neighbor policy, foreign countries might

take some retaliatory steps, which would lead to contraction of world trade. This contraction damages global interests and violates the aims of the WTO. Thus, our results suggest that WTO should regulate each country's free discretion on privatization.

The remainder of this paper is organized as follows. In Section 1, we formulate the basic setting of this paper, and explain the structure of competition with an exporting STE. In Section 3, we present the two main results on the privatization effect of an exporting STE with respect to both the domestic and foreign equilibrium social welfare. Section 4 concludes with several remarks.

2 The model

2.1 The setting of our paper and structure of competition

As stated in the introduction, we model the situation where an exporting STE is responsible for domestic procurement and exports. Consumers in a domestic country (d), which includes a single desk STE, and a foreign country (f) have the same preference for the good, which is given by the following inverse demand functions:

$$P_i = P_i(Q_i) = a - Q_i, \qquad i = d, f,$$

where P_d and P_f are the consumer prices in the domestic and the foreign country, respectively; $Q_d = q_d - X$ and $Q_f = q_f + X$ represent the quantities sold in the domestic and foreign markets, respectively; q_d, q_f, and X are, respectively, the quantities produced by the domestic and foreign producers and the exports to the foreign country.

The cost functions of the producers in both countries are assumed to be symmetric and quadratic, i.e., $C_i(q_i) = \frac{1}{2}kq_i^2$ ($i = d, f$). All the goods of the domestic producer are assumed
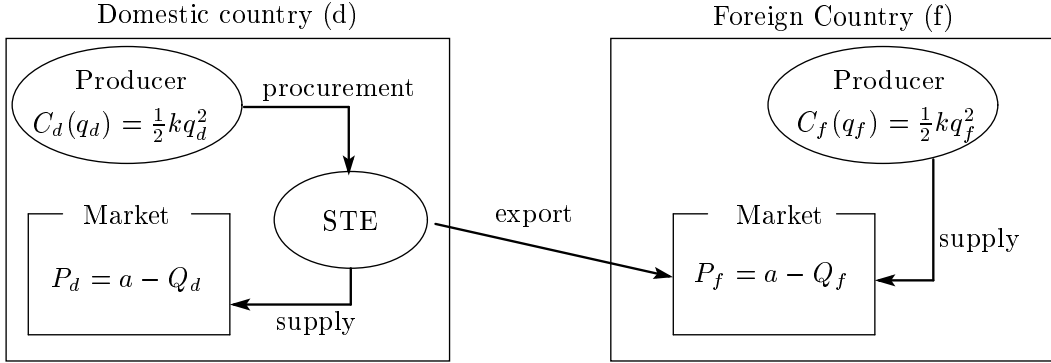
5

Figure 1: Setting of the paper

to be purchased by the STE at the price, P_{STE}, which the STE proposes. This implies that the domestic producer acts as a price taker and maximizes profits $\Pi_d = P_{STE}q_d - C_d(q_d)$. Taking into account the domestic producer being a price taker, this function is rewritten as

$$\Pi_d(q_d) = C'_d(q_d)q_d - C_d(q_d) = \frac{1}{2}kq_d^2.$$

On the other hand, since there do not exist any STEs in the foreign country, the foreign firm is assumed to have a pricing power. Then, the profits of the firm are as follows:

$$\Pi_f(q_f, X) = P_f(Q_f)q_f - C_f(Q_f) = \frac{1}{2}q_f\left[2a - (k+2)q_f - 2X\right]. \tag{1}$$

Note that the foreign good market is duopolistic where the foreign producer and the domestic STE compete. This is some kind of Cournot competition, but the STE supplies not the goods which it produces by itself but the rest of the goods which the STE procures from the domestic producer and sells to the domestic consumers. This is in sharp contrast to the usual Cournot competition. Figure 1 illustrates the setting described above.

Now let us describe the behavior of the STE. Although there are several possible characteri-

6

zations of STEs that could apply in exporting countries, we focus on the characterization of the STE that emphasizes the effects of protecting the domestic producers and allows us to assess the influences of such protection on both domestic and foreign welfare. Specifically, the STE, which has rights to procure from the domestic producer and to export, aims to maximize the following welfare function inclining slightly toward the domestic producer's benefits:

$$V(q_d, X, q_f) = W_d(q_d, X, q_f) + (\rho - 1)\Pi_d(q_d),$$

$$= \frac{1}{2} \left\{ 2aq_d + 2q_dX - (2q_f + 3X)X - [1 + (2 - \rho)k] q_d^2 \right\},$$

where $W_d(q_d, X, q_f)$ is the non-biased domestic welfare, defined as the sum of the consumers' surplus and the producers' surplus, i.e.,

$$W_d(q_d, X, q_f) = \int_0^{Q_d} P_d(z)dz - P_d(Q_d)Q_d + \Pi_d(q_d) + \Pi_{STE}(q_d, X, q_f),$$

and $\Pi_{STE}(q_d, X, q_f)$ represents the profits of the STE, which is defined as the revenues from the domestic and foreign markets after the payment to the domestic producer, i.e.,

$$\Pi_{STE}(q_d, X, q_f) = P_d(Q_d)Q_d + P_f(Q_f)X - P_{STE}q_d.$$

Note that ρ is the degree of the protection of the STE provides to the domestic producer. In fact, the objective of the STE, V, is equalized to the non-biased welfare, W_d, if $\rho = 1$, and the STE gets to emphasize the domestic producer's profits as ρ increases. As pointed out in the introduction, the STE has a propensity to protect the domestic producers in order to sustain their production and lives. Nevertheless, it seems difficult to place the highest priority on the domestic producers' benefits bluntly, even at any cost of consumers. Such blunt protection would run into strong opposition from the domestic consumers. Then, we assume that the degree of protection ρ is not

that high, and the following assumption indicates this.

Assumption 1. *The degree of protection ρ is relatively small so that $\rho \in [1, 2]$.*[10]

Further, note that the STE is some sort of a middleman. The STE proposes its purchase price for the goods to the domestic producer and purchases them to resell in the foreign market. In short, the STE earns a profit by bearing costs as payment to the domestic producer and by selling the foreign consumers the relevant goods. A point that differentiates the STE considered in the paper from a simple middleman is that the STE sells to not only the foreign consumers but also the domestic consumers. Thus, the revenue from selling to the domestic consumers is also accrued to the STE.

For the succeeding analysis, we assume that the STE, aspecting the action of the domestic producer as a price taker, selects the amount of procurement and exports. On the other hand, the foreign producer is assumed to select only his output to maximize profits. In addition, the STE and the foreign producer simultaneously choose their control variables.

2.2 Deriving equilibrium outcomes

Having proposed and explained the model of this paper, let us proceed to deriving equilibrium outcomes. Assuming Cournot behavior and using Eq. (1), the first-order condition of the foreign producer for profit maximization is

$$\frac{\partial \Pi_f}{\partial q_f} = a - (k + 2)q_f - X = 0. \tag{2}$$

This equation yields the reaction function of the foreign producer, $q_f = R_f(X) = \frac{a-X}{k+2}$. As expected, the foreign producer's reaction depends only on the exports by the STE. On the other

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[10]As observed later, this assumption makes the optimization problems of the STE sensible.

hand, the maximization problem for the STE is $\max\limits_{\{q_d,X\}} V(q_d, X, q_f)$ and therefore the first-order condition is

$$\frac{\partial V}{\partial q_d} = a + X + q_d\left[-1 + k(-2 + \rho)\right] = 0, \tag{3}$$

$$\frac{\partial V}{\partial X} = -q_f + q_d - 3X = 0. \tag{4}$$

Note that under Assumption 1, V is concave in (q_d, X) and as a result the second-order condition is satisfied. In fact,

$$\frac{\partial^2 V}{\partial q_d^2} = \left[-1 + k(-2 + \rho)\right] < 0, \quad \frac{\partial^2 V}{\partial X^2} = -3 < 0,$$

$$\frac{\partial^2 V}{\partial q_d^2} \cdot \frac{\partial^2 V}{\partial X^2} - \left(\frac{\partial^2 V}{\partial X \partial q_d}\right)^2 = 2 + 3k(2 - \rho) > 0.$$

From Eqs. (3) and (4), we obtain the reaction functions of the STE,

$$q_d = R_d^q(q_f, \rho) = \frac{3a - q_f}{2 + 3k(2 - \rho)}, \qquad X = R_d^x(q_f, \rho) = \frac{a - q_f\left[1 + k(2 - \rho)\right]}{2 + 3k(2 - \rho)}.$$

It is straightforward to see that both procurement and exports are negatively related to foreign production. In particular, the slope of R_d^x is steeper than that of R_d^q. The foreign producer's increasing production worsens the terms of trade for the domestic country, and, thus the STE has a strong incentive to decrease its exports. On the other hand, its incentive to decrease its procurement becomes weak, since the STE takes the domestic consumers' benefits from their demand into consideration. Further, note that an increase in the degree of protection raises both domestic production and exports. The reason for a positive relationship between R_d^q and ρ is that with the degree of protection being higher, the STE attempts to raise the domestic producer's profits by increasing its procurement. In contrast to the relationship between R_d^q and ρ, the relation-

ship between R_d^x and ρ is somewhat complicated. This along with Eq. (4) indicates the positive relationship of q_d and X, and it turns out that the STE attempts to not sell all the increment in procurement through a rise in ρ but to replace a part of the increment in procurement with exports. This is because if the increments in procurement are cleared only in the domestic markets, then the domestic price becomes drastically low and STE's profits become severely low.

Solving the reaction functions of both firms gives the equilibrium outputs and exports:

$$q_d^*(\rho) = \frac{a(4+3k)}{3+3k^2(2-\rho)+k(12-5\rho)}, \quad q_f^*(\rho) = \frac{a[1+3k(2-\rho)]}{3+3k^2(2-\rho)+k(12-5\rho)},$$
$$X^*(\rho) = \frac{a[1+k(\rho-1)]}{3+3k^2(2-\rho)+k(12-5\rho)}.$$

The outputs of the foreign producer exceed the exports from the domestic country, while the outputs of the domestic producer exceeds those of the foreign producer. In addition, simple calculation reveals that in equilibrium, domestic demand is higher than foreign demand for any $\rho \in [1,2]$, and thus foreign consumers face higher consumer price than domestic consumers. This is due to the following facts. First, the foreign market is a duopolistic market which comprises of the profit-maximizing foreign producer and the STE having an incentive to increase its revenue from the market so as to enhance the domestic producer's benefits. Second, the STE selects the procurement from the domestic producer and the exports, taking the domestic consumers' benefits into account. Therefore, it chooses them keeping the domestic consumer price relatively low.

As described in the introduction, one of the paper's aims to assess is how the degree of the protection accorded to domestic producers affects the behavior of STEs and the resulting equilibrium outcomes. For this purpose, we illustrate the effects of ρ on the equilibrium outputs and exports using Figure 2. In this figure, three curves are drawn: curve $R_f R_f'$ is the reaction curve of the foreign producer, $R_d^q R_d^{q\prime}$ is the reaction curve of the STE with respect to domestic procurement, and $R_d^x R_d^{x\prime}$ is the reaction curve of the STE with respect to exports. Since the reaction function

10

X, q_d

a — R_f

$\frac{3a}{2+3k(2-\rho)}$ — R_d^q

$q_d^*(\rho)$ .... E' .... $R_d^{q'}$

$\frac{a}{2+3k(2-\rho)}$ — R_d^x

$X^*(\rho)$ .... E

R_f' — $R_d^{x'}$

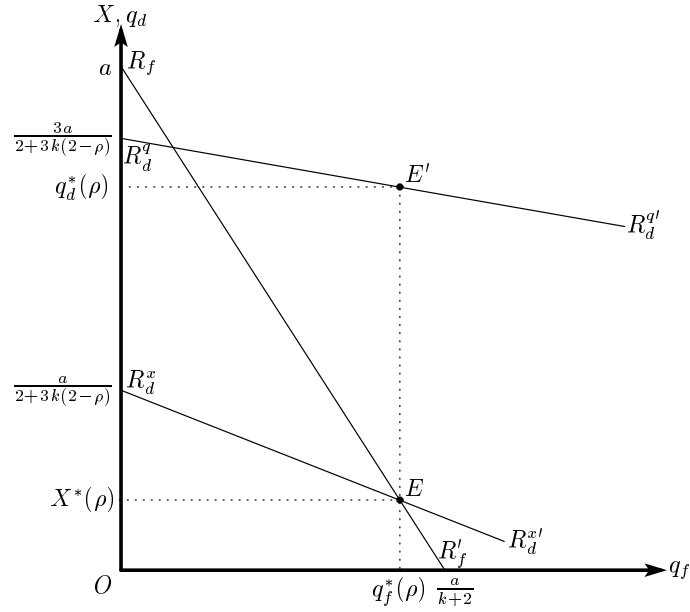O \qquad\qquad $q_f^*(\rho)$ \quad $\frac{a}{k+2}$ \qquad q_f

Figure 2: Illustration of the determination in equilibrium outputs and exports

R_f is dependant only on exports, equilibrium exports and foreign production are determined as an intersection of curves $R_f R_f'$ and $R_d^x R_d^{x'}$ — point E. This level of foreign production yields equilibrium domestic procurement along $R_d^q R_d^{q'}$, which is indicated by E' in Figure 2. We now demonstrate how points E and E' are affected by ρ. As stated above, an increase in ρ shifts both reaction curves $R_d^q R_d^{q'}$ and $R_d^x R_d^{x'}$ outward. From Figure 2, this fact directly suggests that both the domestic procurement and exports expand and the foreign production contracts. Furthermore, coupled with the fact that the slope of the foreign producer's reaction curve is less than unity in absolute value, we find that the foreign demand Q_f in equilibrium becomes larger. Accordingly, a rise in ρ improves the terms of trade for the foreign country.

11

We now focus on equilibrium profits which are given as

$$\Pi_d^*(\rho) = \frac{a^2 k (4 + 3k)^2}{2 \left[3 + 3k^2(2 - \rho) + k(12 - 5\rho)\right]^2}, \quad \Pi_f^*(\rho) = \frac{a^2(2 + k) \left[1 + 3k(2 - \rho)\right]^2}{2 \left[3 + 3k^2(2 - \rho) + k(12 - 5\rho)\right]^2},$$

$$\Pi_{STE}^*(\rho) = \frac{a^2 \left[1 - 14k(\rho - 1) - 9k^3(\rho - 1) - k^2(25 - 26\rho + \rho^2)\right]}{\left[3 + 3k^2(2 - \rho) + k(12 - 5\rho)\right]^2}.$$

Intuitively, the domestic producer gains and the foreign producer loses from an increase in ρ. The higher the value of ρ, the more aggressively the STE exports to the foreign country, which leads to the lowering of the price in the foreign market. Moreover, the foreign producer refrains from its production through the strategic interaction. Therefore, the profits accrued to the foreign producer become smaller. To realize such aggressive exports, the STE must propose a higher price to the domestic producer, and thus the domestic producer is able to enjoy the higher profits.

Note that the profits of the STE might be negative when ρ is sufficiently high. Indeed,

$$\Pi_{STE}^*(1) = \frac{a^2}{(3 + 7k + 3k^2)^2} > 0, \qquad \Pi_{STE}^*(2) = -\frac{a^2(-1 + 14k + 23k^2 + 9k^3)}{(3 + 2k)^2}.$$

In the case of $\rho = 1$, the STE receives the positive profits for any marginal cost parameter $k > 0$. However, in the case of $\rho = 2$, the profits could be negative when k is not at the lower level.

Finally, we mention domestic equilibrium welfare and foreign equilibrium welfare that is defined as the sum of foreign consumers' and producer's surplus, i.e., $W_f = \int_0^{Q_f} P(z)dz - P(Q_f)Q_f + \Pi_f$. The two are given as follows:

$$W_d^*(\rho) = \frac{a^2 \left[11 + 34k(2 - \rho) + 9k^3(3 - 2\rho) + 3k^2(30 - 20\rho + \rho^2)\right]}{2 \left[3 + 3k^2(2 - \rho) + k(12 - 5\rho)\right]^2},$$

$$W_f^*(\rho) = \frac{a^2 \left[6 + 9k^3(2 - \rho)^2 + 5k(9 - 4\rho) + k^2(109 - 98\rho + 22\rho^2)\right]}{2 \left[3 + 3k^2(2 - \rho) + k(12 - 5\rho)\right]^2}.$$

Unlike equilibrium outputs, exports, and profits, it is not that obvious whether the degree of protection enhances or deteriorates domestic and foreign welfare. Differentiating both welfare functions $W_i^*(\rho)$ $(i = d, f)$ with respect to ρ, we have

$$W_d^{*\prime}(\rho) \gtreqless 0 \quad \Longleftrightarrow \quad \rho \lesseqgtr 1 + \frac{1}{k(19 + 27k + 9k^2)},$$

$$W_f^{*\prime}(\rho) \gtreqless 0 \quad \Longleftrightarrow \quad \rho \gtreqless 1 + \frac{2}{4 + k}$$

In other words, a rise in ρ improves domestic welfare and aggravates foreign welfare when ρ remains low, and vice versa. Provided that ρ is sufficiently large, an additional rise in ρ results in the lower profits for the STE, which leads to the deterioration of domestic welfare. On the other hand, such an additional rise in ρ strengthens the terms of trade improving effects for the foreign country, thus the foreign welfare increases. Conversely, provided that ρ is sufficiently small, an increase in ρ drastically benefits the domestic consumers by lowering the domestic consumer price. This effect would overwhelm the negative effect of the STE's decreasing profits. In the foreign country, the foreign producer loses its market shares and moreover the market price decreases. This results in the effect of foreign producer's worsening profits becoming dominant over the terms of trade improvement effect. Therefore, foreign welfare decreases.

Interestingly, the biased welfare-maximizing STE can give higher welfare than the welfare-maximizing STE because $W_d^{*\prime}(1) > 0$. Although seemingly very surprising, this is relatively well known in the context of mixed oligopoly. Matsumura (1998), using the setting where there is a firm jointly owned by the public and private sectors that competes against one private firm, and where this jointly owned firm is assumed to maximize the weighted average of welfare and its profits, shows that such a jointly owned firm can attain the higher welfare than the pure welfare-maximizing public firm. Given that the objective function of the jointly owned firm is continuous with respect to the weights, the reaction curve of the firm lies between that of a pure profit max-

imizer and that of a pure welfare maximizer and as a result, the equilibrium arises between an intersection of the rival's and pure profit maximizer's reaction curves and an intersection of the rival's and pure welfare-maximizer's reaction curves. This implies that the allocation of such an equilibrium might verge on allocation of Stackelberg competition where the welfare-maximer is a leader. The intuition behind our result is analogous to Matsumura's.[11]

We should also note that the domestic welfare could be negative under some values of parameters k and ρ. The reasoning is as follows. As stated above, the profits of the STE could be negative when both k and ρ are sufficiently large. In addition, a larger ρ promotes inefficient production of the domestic producer because of a higher marginal cost parameter k. These two negative factors might dominate the positive factor that consumers enjoy the lower consumer price though higher ρ. Avoiding such negativity in domestic welfare, we assume the following.

Assumption 2. *For any $\rho \in [1, 2]$, the domestic welfare is positive.*[12]

3   Privatization

In this section, we attempt to demonstrate the effect of privatizing the STE. In the mixed oligopoly theory, a large number of papers have tackled the privatization of public enterprises and the effects of privatization on welfare. In these papers, privatization is assumed to be a change in the public enterprises' objective functions. Specifically, privatized enterprises become profit-maximizing enterprises. Such an assumption underlies the following idea with respect to the ownership of

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[11]As pointed out in the introduction, White (2002) also employs a model similar to Matsumura (1998), where one public firm aiming to maximize the generalized welfare which is defined as the weighted average of consumer's and producer's surplus competes against private firms. Of course, the intuition behind our results is also analogous to White's.

[12]This assumption can be replaced with the condition $k < \hat{k}$, where $\hat{k} = \{k \mid 9k^3 + 18k^2 - 11 = 0\}$. Assumption 2 requires that the numerator of $W_d^*(\rho)$ should be positive for any $\rho \in [1, 2]$. Differentiating it with respective to ρ, we find that the differential is negative. Then, we obtain $f(k) = 9k^3 + 18k^2 - 11$ evaluating the numerator of $W_d^*(\rho)$ at $\rho = 2$. Solving the cubic equation $f(k) = 0$ yields $\hat{k}$. Further, we find that $\hat{k}$ is unique, since two of the roots are complex numbers.

firms. Before privatization, the benevolent government has all the shares in the enterprises, and thus it controls them to act as welfare maximizers. Once those shares are sold to the private sector, the private sector tries to control the enterprises to behave as a profit maximizer in order to raise dividends on shares.

In line with the literature on mixed oligopoly, we investigate the privatization of the STE as a change from a biased-welfare maximizer to a profit-maximizer. Then, the first-order condition of the profit maximizing STE is

$$\frac{\partial \Pi_{STE}}{\partial q_d} = a - 2(q_d + kq_d - X) = 0, \tag{5}$$

$$\frac{\partial \Pi_{STE}}{\partial X} = -q_f + 2q_d - 4X = 0. \tag{6}$$

Eqs. (2), (5), and (6) give rise to the following equilibrium outcomes.

$$q_d^{**} = \frac{a(5 + 4k)}{6 + 18k + 8k^2}, \quad q_f^{**} = \frac{a(1 + 4k)}{3 + 9k + 4k^2}, \quad X^{**} = \frac{a}{3 + 9k + 4k^2},$$

$$\Pi_d^{**} = \frac{a^2 k(5 + 4k)^2}{8(3 + 9k + 4k^2)^2}, \quad \Pi_f^{**} = \frac{(2 + k)(a + 4ak)^2}{2(3 + 9k + 4k^2)^2}, \quad \Pi_{STE}^{**} = \frac{a^2(13 + 49k + 56k^2 + 16k^3)}{4(3 + 9k + 4k^2)^2},$$

$$W_d^{**} = \frac{a^2(35 + 147k + 168k^2 + 48k^3)}{8(3 + 9k + 4k^2)^2}, \quad W_f^{**} = \frac{a^2(6 + 33k + 56k^2 + 16k^3)}{2(3 + 9k + 4k^2)^2}.$$

Since the privatized STE no longer takes the domestic consumers' and the domestic producer's benefits into account, it attempts to procure the good from the domestic producer at a lower price and sell it to the domestic consumers at a higher price. Further, it restrains exports for fear that the consumer price in the foreign market may decrease.

15

3.1 Comparison between domestic welfare pre- and prost-privatization

We now examine the effect of privatization on the domestic welfare. Substracting $W_d^*(\rho)$ from W_d^{**}, we have

$$\Delta W_d(\rho) := W_d^{**} - W_d^*(\rho) = \frac{a^2 \Omega}{8(3 + 9k + 4k^2)^2 \left[-3 + 3k^2(-2 + \rho) + k(-12 + 5\rho)\right]^2},$$

where

$$\Omega = -81 + 144k^7\rho(-4 + 3\rho) + 3k(-327 + 58\rho) + 24k^6(-24 - 140\rho + 115\rho^2)$$

$$+ k^2(-4152 + 264\rho + 767\rho^2) + 3k^3(-2704 - 686\rho + 1359\rho^2) + k^5(-3488 - 7076\rho + 6699\rho^2)$$

$$+ k^4(-7796 - 6408\rho + 7665\rho^2)$$

Unfortunately, it is not that easy to see whether privatization improves domestic welfare. All we can ascertain is that privatization is desirable for the domestic country if both k and ρ are sufficiently large, whereas privatization is not desirable if they are small.

In some cases of privatization, it has been empirically proved that the inefficiency in public enterprises, such as the inefficiency in technological aspects, the inefficient usage of some resources and X-inefficiency, impedes normal profits. On the basis of this evidence, many politicians and industrialists and even some economists advocate that all the public enterprises running at a loss should be privatized, thereby giving them incentives to gain profits and moreover resulting in welfare improvement. To clarify whether this is the case, we examine the relationship between the change in domestic welfare through privatization and the STE's profits before privatization. Figure 3 illustrates the relationship between $\Delta W_d(\rho)$ and $\Pi_{STE}^*(\rho)$. Curves aa' and bb' represent the schedules implying $\Delta W_d(\rho) = 0$ and $\Pi_{STE}^*(\rho) = 0$, respectively. These two curves divide a plane into three regions: the first is the region below both aa' and bb' (named Region 1); the
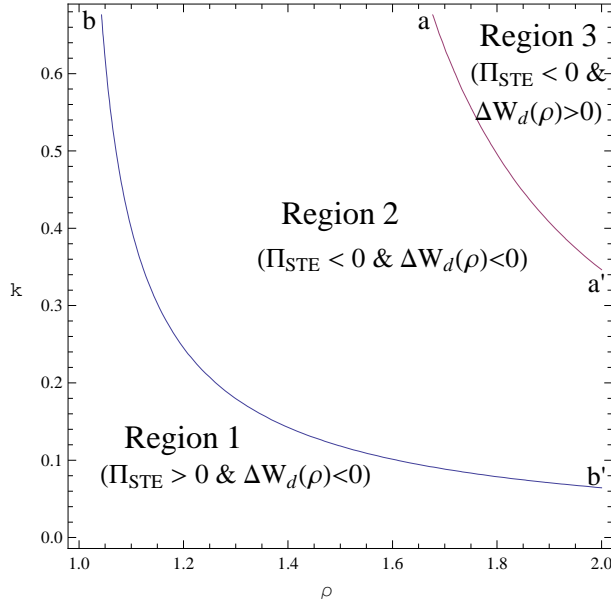
Figure 3: Relationship between benefits from privatization and profits of the STE

second is the region below aa' but above bb' (named Region 2); and the third is the region above both curves (named Region 3). As indicated in Figure 3, the profits of the STE are positive before privatization but privatization decreases the domestic welfare in Region 1. In Region 2, the profits are negative and privatization deteriorates welfare, and in Region 3 the profits are negative but privatization enhances welfare. These results are summarized as follows.

Proposition 1. *Whenever privatization improves the domestic welfare, the STE before privatization operates at a loss. In addition, whenever the STE earns the positive profits, privatization exacerbates the domestic welfare.*

We now explain the intuition behind this proposition. First, we consider the case where privatization improves the domestic welfare. In this case, as depicted in Figure 3, both k and ρ are very high. Recall that the biased-welfare maximizing STE encourages the domestic producer to produce more and endeavors to export more vigorously than the profit-maximizing STE. This

17

implies that the STE faces fairly high domestic procurement costs and further must sell the foreign consumers the relevant good at a very low price, which leads to a serious deficit in the STE before privatization. Next, we consider the case where the STE earns the positive profits before privatization. In this case, as shown in Figure 3, either k or ρ is very low—low k results in low procurement costs for the STE and a low ρ discourages the STE to purchase the good excessively from the domestic producer. In either case, the positive profits are accrued to the STE. Then, why is the domestic country harmed by privatization? This is because in addition to such positive profits of the STE, the domestic country enjoys the consumers' benefits from the lower consumer price. These two positive effects dominate the cost-saving effect of underproduction by the domestic producer through privatization.

Note that Proposition 1 never states that the STE that earns negative profits should be privatized. In fact, for any given pair (ρ, k) in Region 2, privatization leads to a decrease in welfare, though the profits are negative. This implies that the prevalent and typical point of view on public enterprises and privatization, as seen in the documents and statements of many politicians, industrialists, and economists—inefficient public firms should be privatized—need not hit the mark.

3.2   Comparison between foreign welfare pre- and post-privatization

In the previous subsection, we have observed the relationship between the change in domestic welfare through privatization and the profits of the STE. This observation is based on the viewpoints of the domestic country. Seeing that the STE engages in exports to the foreign country irrespective of whether or not it is privatized, privatization inevitably influences the foreign producer's behavior and the foreign welfare. For this reason, it is vital to carefully specify how foreign welfare is altered by the privatization of the domestic STE.

To this end, we consider the influence of privatization on the welfare of the foreign country

and calculate the change in the welfare before and after privatization, which yields the following:

$$\Delta W_f(\rho) = W_f^{**} - W_f^*(\rho)$$

$$= -\frac{a^2 k^2 \left[-3 + 4k(-1 + \rho) + 4\rho\right]\left[4k^3(-1 + \rho) + 17k^2(-3 + 2\rho) + 3(-9 + 4\rho) + k(-93 + 54\rho)\right]}{2(3 + 9k + 4k^2)^2 \left[-3 + 3k^2(-2 + \rho) + k(-12 + 5\rho)\right]^2}.$$

As in the case of the domestic welfare, we cannot ascertain whether privatization improves the foreign welfare. Nevertheless, privatization improves foreign welfare when ρ is low, whereas it deteriorates the foreign welfare when ρ is sufficiently high. The higher the value of ρ, the more the biased-welfare-maximizing STE exports. On the other hand, the privatized STE restrains its exports to not decrease the foreign consumer price. These facts directly indicate that the terms of trade drastically worsen for the foreign country for a relatively higher ρ. Thus, in the case where the STE overprotects the domestic producer, the foreign country suffers from the deterioration of welfare by privatization.

The above equation shows that a privatization policy that considers the interest of the domestic country can harm the foreign country. Here, one question arises: Are there situations where privatization is desirable for both countries? Seemingly, the answer to this question is negative, since privatization benefits the domestic country while it harms the foreign country for a higher ρ. However, this is not the case, which is demonstrated in Figure 4. In this figure, a new curve named cc' is drawn. This curve is the schedule representing $\Delta W_f(\rho) = 0$. Privatization worsens foreign welfare above this curve and improves the same below the curve. Curves cc' and aa'
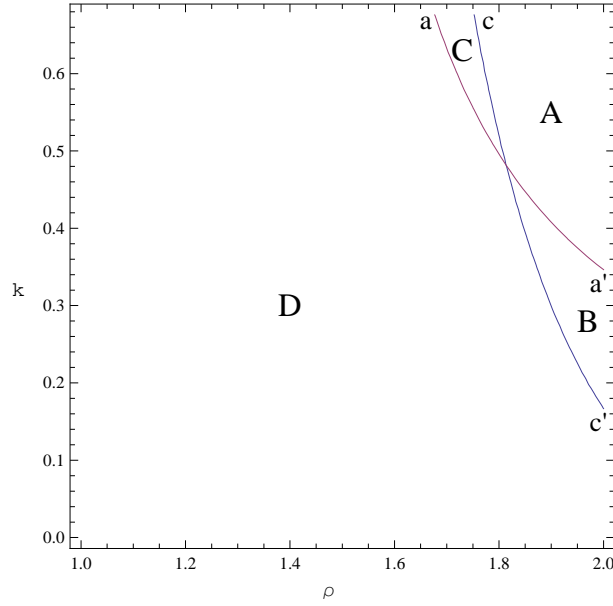
Figure 4: Changes in the domestic and foreign welfare after privatization

divide a plane into four regions: A, B, C, and D.

$$A = \left\{(\rho, k) \mid \Delta W_d(\rho) > 0 \ \text{ and } \ \Delta W_f(\rho) < 0\right\},$$

$$B = \left\{(\rho, k) \mid \Delta W_d(\rho) < 0 \ \text{ and } \ \Delta W_f(\rho) < 0\right\},$$

$$C = \left\{(\rho, k) \mid \Delta W_d(\rho) > 0 \ \text{ and } \ \Delta W_f(\rho) > 0\right\},$$

$$D = \left\{(\rho, k) \mid \Delta W_d(\rho) < 0 \ \text{ and } \ \Delta W_f(\rho) > 0\right\}.$$

From Figure 4, we establish the following proposition.

Proposition 2. *When both the marginal cost parameter k and the degree of protection ρ are sufficiently high, privatization of the STE improves the domestic welfare but is a beggar-thy-neighbor policy. When only k is very high and ρ is not so high, both countries enjoy benefits from privatization.*

20

The intuition behind this proposition is as follows. Ultimately, given the higher level of k, the level of ρ matters in determining whether privatization improves or exacerbates foreign welfare. Recall that the higher the value of ρ, the more aggressively the STE acts in the foreign market. This aggressive behavior generates two counter-balancing effects for foreign welfare: one is the improvement in the terms of trade that benefits the foreign consumers and the other is the decrease in profits of the foreign producer due to a decrease in price. Provided that ρ is high enough to be around 2, the latter effect is stronger than the former, and thus privatization leads to the deterioration of the foreign welfare. On the other hand, the former effect dominates the latter when ρ is not so high. In this case, the foreign welfare improves through privatization.

4 Concluding Remarks

This paper investigated the behavior of the exporting STE that has a propensity for protecting the domestic producers. In particular, adopting the mixed oligopoly approach, we analyzed whether privatization of the exporting STE responsible for procurement and exports increases both domestic and foreign welfare. The STE was assumed to maximize the biased welfare inclining slightly toward the domestic producers and to compete against the foreign producers in the foreign market à la Cournot competition. Then, we examined how the degree of protection accorded influences the effects of privatization on the domestic and foreign welfare.

First, in Proposition 1, we showed that (*i*) privatization enhances the domestic welfare, only if the profit of the STE is negative before the privatization, and that (*ii*) the profits of the STE are positive only if privatization deteriorates domestic welfare. These results imply that the negative profits of the STE need not justify privatization in terms of the domestic welfare. Second, we found other surprising results with regard to the relationship between the domestic and the foreign welfare, which is stated in Proposition 2. The proposition states that (*iii*) if the degrees

of both each firm's inefficiency and protection accorded to the domestic producer by the STE are sufficiently high, privatization increases foreign welfare, and (*iv*) if the degree of the inefficiency in each firm is quite high and the degree of the protection accorded to the domestic producer by the STE is not that high, social welfare in both countries is improved through privatization. These results would suggest that Proposition 2 issues an alarm for the countries holding STEs to not undertake privatization recklessly. Such a reckless privatization policy applied by one government, which exacerbates the welfare of other foreign countries, may well result in retaliation and unexpected trade protectionism, and moreover may well contract world trade. For avoiding trade protectionism and contraction of world trade, WTO would be required to restrict privatization.

Finally, we make a remark on further extensions of our model. Although we considered the situation where there exists an STE in the domestic country, we should also analyze the case wherein the foreign county has an STE. As a plausible next step, we must investigate a model with STEs in each country and where each firm chooses its output level and not only sells in its respective domestic market but also exports to the third country market, as in McCorriston and MacLaren (2007a). Furthermore, in this paper, we supposed the existence of an exporting STE. Then, as our future research, we should conduct a similar analysis for an importing STE. Finally, although we investigated only the privatization of the STE as the policy-making of the government, it is necessary to consider the situation where the government uses an export subsidy. Extending our model in these directions remains for the future.

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