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# Optimal Competition Policy for Marketing Boards

Sanghack Lee · Sanghoon Lee

This paper derives the optimal competition policy for marketing boards. The optimal number of export marketing boards proves to be one plus the ratio of the slope of an export supply curve relative to that of an import demand curve. The competition policy for export marketing boards is also shown to be equivalent to the export tax policy. For import marketing boards, the optimal number is given as one plus the ratio of the slope of an import demand curve relative to that of an export supply curve. The competition policy for import marketing boards is equivalent to the import tariff policy as well. The optimal numbers of marketing boards are expressed in terms of elasticities of import demand and export supply.

## I. Introduction

A large proportion of international trade in agricultural products is conducted through marketing boards. They exist for a variety of products such as cocoa, coffee, rice, tea, wheat, etc. As evidence of their significant role in international trade, Krishna and Thursby [6] note that the Ghanan and Nigerian Boards together accounted for 40 percent of world cocoa exports in the 1960s and 1970s. They also note that sales of the Asian boards for tea currently account for two-thirds of U.S. tea imports. Moreover, some portion of trade in manufactured goods is also performed through marketing boards. National governments often encourage their trading corporations to carry out the role of marketing boards for such products. Sogo-shosas in Japan and general trading companies in Korea are examples pertaining to such government policy.[1]

Associate Professor, Kookmin University, Seoul, 136-702, South Korea and Research Fellow, Kyonggi Development Institute, Kyonggi, 442-070, South Korea, respectively. The research of the first author has been supported by a research grant from Kookmin University.

While marketing boards play an important role in international trade of both developed and developing countries, their objectives vary greatly across products and countries. In some cases, marketing boards purport to maximize the interest of competitive producers, while in other cases they try to maximize social welfare, acting as government agencies. They are often set up as revenue-raising devices as well. These imply that diverse objectives of marketing boards do not necessarily reflect social welfare. Thus, the tax/subsidy policy is called for to offset distortions associated with the boards behavior. Markusen [9] employs a general equilibrium model to analyze such tax/subsidy policy necessary to affect distortions associated with the behavior of the boards that maximize the profits of competitive producers. More recently, Krishna and Thursby [6] examine optimal tax/subsidy policies for marketing boards who compete as oligopolists in world markets.

Since marketing boards affect flow of international trade, government policies toward them constitute trade policy.[2] Thus, it is natural to compare the policy for marketing boards with other trade policies such as export tax or import tariff. The other important point related to marketing boards and neglected in the received literature is the possibility of existence of multiple marketing boards for a single product. An implicit assumption in the received literature is that for each product there exists a single board which purports to maximize either its own profit or national welfare.[3] In some instances, however, several marketing boards are in charge of international trade of the same product. For example, in Korea, feed grain is imported by four agencies similar to marketing boards. Also, export of agricultural products of Korea is mostly conducted by a few trading companies.

The purpose of this paper is to derive optimal competition policy for export and import marketing boards, respectively. By competition policy we mean allocation by government of "licenses to trade" without quantity restriction. This policy is different from quotas in that no quantity restriction is imposed on license holders. Each board is

1) Cho [3] offers a detailed discussion of the role of trading corporations. In general trading corporations deal with a vast varety of products, while marketing boards account for specialized items, respectively.

2) Schmitz et al. [10] recognize marketing boards as one of several forms of cartel institutions.

3) When the objective of a board is to maximize national welfare, there exists an issue of incentive-compatibility, since the board is prone to maximize its own profit rather than national welfare. Managerial efficiency of marketing boards may be evaluated by measurable profits of the boards rather than by national welfare which is hard to measure. The possibility that a single board treats several products is considered in Lee and Lee [8].

assumed to act as a profit-maximizing Cournot-Nash competitor. Hence the government has only to assign licenses and need not audit behavior of marketing boards. In other words, the competition policy for marketing boards is incentive-compatible from the point of view of the government. The optimal number of marketing boards turns out to depend critically on slopes of import demand and export supply curves. For export marketing boards, the optimal number is given as one plus the ratio of the slope of an export supply curve relative to the absolute slope of an import demand curve. For import marketing boards, the optimal number is given as one plus the ratio of the absolute slope of an import demand curve relative to the slope of an export supply curve.

The competition policy for marketing boards is also compared to trade tax policy. The competition policy for export marketing boards proves to be equivalent to the export tax policy. The competition policy for import marketing boards is shown to be equivalent to the import tariff policy as well. It is also shown that the optimal number of marketing boards can be expressed in terms of optimal trade taxes and elasticities of import demand and export supply.

This paper is organized as follows. Section Ⅱ sets out the basic model and derives optimal competition policy for export marketing boards. Nash equilibrium of policy interaction of governments, as in Brander and Spencer [2], is examined in section Ⅲ. Section Ⅳ examines the optimal competition policy for import marketing boards. The final section provides concluding remarks.

## Ⅱ. Competition Policy for Export Marketing Boards

We adopt a partial equilibrium model of a single product to analyze the optimal competition policy for marketing boards. The world consists of two countries, called home and foreign and labeled $H$ and $F$, respectively. Consider a competitively-organized export industry of country $H$. The export supply of country $H$ for the product is given as $S(Q)$, where $S' \geq 0$ and $Q$ denotes the export volume of the industry. The (inverse) import demand of country $F$ for the product is given by $P(Q)$, where $P' < 0$. We examine the case, as noted by Dixit [4, p. 2], in which export marketing activities are carried out by a few trading corporations, say, marketing boards. The government of country $H$ assigns "licenses to export" without quantity restriction to a few trading corporations. Then, license holders purchase products and export the products without any quantity restriction. Note that this policy is different from export quota in that no restriction is imposed on quantity each board can purchase and sell. Each board is assumed to be a profit-maximizing Cournot-Nash competitor and purchase products only in the home market and sell them in the foreign market. For simplicity, we assume that no cost is associated with marketing activities of the boards.

In the first place, we specify the interaction between export marketing boards for a given number of marketing licenses, $n$. Then, the optimal competition policy of home government will be derived in the latter part of this section. The profit board $i$ obtains by marketing $q_i$ amount is written as

$$\Pi^i = [P(Q)] - S(Q)q_i, \tag{1}$$

where $Q(=\sum_i q^i)$ denotes the aggregate export volume of the industry. The boards are interrelated with each other in the home (input) market as well as in the foreign (output) market. Export board $i$ tries to maximize its own profit $\Pi^i$ by suitably choosing quantity $q_i$. The first-order condition for profit maximization is

$$\partial\Pi^i/\partial q_i = P + P'q_i - S - S'q_i = 0. \tag{2}$$

By terminology of Helpman and Krugman [5], the term $(P + P'q_i)$ in equation (2) denotes the "perceived marginal revenue" of an additional sale from the point of view of board $i$. Analogously, the term $(S + S'q_i)$ denotes the "perceived marginal cost" of an additional sale of board $i$.[4] The first order condition for profit maximization requires that the "perceived marginal revenue" is equated to the "perceived marginal cost". Summation of the first-order conditions over $i=1, \cdots, n$, yields

$$\sum(\partial\Pi^i/\partial q_i) = nP + P'Q - nS - S'Q = 0. \tag{3}$$

Equation (3) gives $Q$ as an explicit function of $n$, To express $Q$ as an explicit function of $n$, we further assume that, for any $i$ and $j$, $i \neq j$, the following inequalities are satisfied:

4) While utilizing the concept of "perceived marginal revenue" quite extensively, Helpman and Krugman [5] pay little attention to the cost side. In most of their analysis, the marginal cost curve, corresponding to the export supply curve of this paper, is assumed to be horizontal.

$$\partial(P+P'q_i)/\partial q_j = P' + P''q_i < 0, \tag{4}$$

and

$$\partial(S+S'q_i)/\partial q_j = S' + S''q_i \geq 0. \tag{5}$$

The inequality (4) implies that an increase in export volume of other boards decreases "perceived marginal revenue" of export of board $i$. The weak inequality (5) indicates that an increase of export volume of boards other than $i$ does not decrease "perceived marginal cost" of export of board $i$. These seem to be reasonable assumptions. With these assumptions, the second-order condition for profit maximization is also satisfied. Moreover, disregarding the integer constraint, $Q$ can be expressed as an increasing function of the number of export marketing boards.

**Lemma 1** Export volume $Q$ is an increasing function of the number of export marketing boards $n$.

**proof** By summing $(P'+P'q_i)$ over $i = 1, \cdots, n$, we obtain $nP'+P''Q<0$. Since $P'<0$, it follows that $(n+1)P'+P''Q<0$. Summation of $(S'+S''q_i)$ over $i = 1, \cdots, n$, gives $nS'+S''Q\geq 0$. Hence $(n+1)S'+S''Q\geq 0$. Total differentiation of (3) gives $[(n+1)P'+P''Q-(n+1)S'-S''Q]\mathrm{d}Q+P[(Q)-S(Q)]\mathrm{d}n=0$. Thus,

$$\mathrm{d}Q/\mathrm{d}n = -(P(Q)-S(Q))/[(n+1)P'+P''Q-(n+1)S'-S''Q]. \tag{6}$$

Since the denominator of the right hand side of (6) is negative, it follows that $(\mathrm{d}Q/\mathrm{d}n) > 0$. Q. E. D.

We now derive the optimal competition policy for export marketing boards. National welfare of country $H$, $W^H$, is assumed to be the sum of producer surplus of the industry producing the goods and profits of export marketing boards:

$$\begin{aligned} W^H &= [s(Q)Q - \int_0^Q S(q)\mathrm{d}q] + \sum_i [P(Q)-S(Q)]q_i \\ &= P(Q)Q - \int_0^Q S(q)\mathrm{d}q \end{aligned} \tag{7}$$

Disregarding the integer constraint, the first-order condition for welfare maximization is given as

$$dW^{n}/dn=[P'Q+P-S](dQ/dn)=0. \quad (8)$$

As $(dQ/dn)>0$, The equation, $(P'Q+P-S)=0$, implicitly determines the optimal number of export marketing boards, $n^{*}$. The term $(P'Q+P)$ measures marginal revenue of export, while $S$ denotes marginal cost of export from the home country's point of view. The optimality condition implies that marginal cost of export be equated to marginal revenue of export. Let $Q^{*}$ denote the export volume corresponding to the optimal number of marketing boards $n^{*}$. The optimal number of export marketing boards is then given as follows.

**PROPOSITION 1** The optimal number of export marketing boards is given as one plus the ratio of the slope of the export supply curve relative to the absolute slope of the import demand curve. That is, $n^{*}=1-(S'(Q^{*})/P'(Q^{*}))$.

**proof** From (3) we obtain $n(P-S)=(-P'+S')Q$. Thus, $n=(-P'+S')Q/(P-S)$. As $(P-S)=-P'Q$ by (8), it follows that $n^{*}=1-(S'(Q^{*})/P'(Q^{*}))$. Q.E.D.

Even though $n^{*}$ is not explicitly given, proposition 1 reports an important result regarding the optimal competition policy of an exporting country for export marketing boards. If the export supply is perfectly elastic so that $S'=0$, then complete cartelization constitutes the optimal competition policy of the exporting country, i.e, $n^{*}=1$. When the export supply is not perfectly elastic, however, complete cartelization need not be the optimal policy. The optimal number of export marketing boards tends to increase, the steeper the export supply curve is, and the flatter the import demand curve is. Note that, in most of the received literature on export marketing boards or export cartels, it is implicitly taken for granted that export sales should be conducted by a single export marketing board in order to exploit international market power. Proposition 1 shows that this need not be the case. This is because producer surplus of the supplying industry as well as direct profits of the export boards constitutes national welfare of the exporting country. The steeper the export supply curve is, and the flatter the import demand curve is, producer surplus of the supplying industry gains more importance relative to direct profits of export marketing boards. In such a case, the government may allow for a large number of export marketing boards to increase export volume. When functional forms of demand and supply curves are known, $n^*$ can be explicitly given.

The government of country $H$ may levy export taxes on exports of its competitive industry instead of implementing the competition policy for export marketing boards. Given this possibility, it is interesting to compare the optimal export tax policy with the optimal competition policy for export marketing boards. We compare the optimal competition policy with the ad valorem export tax policy. Let $s$ denote ad valorem export tax rate country $H$ imposes on its competitive export industry. Then, market clearing condition is given as

$$P(Q)=(1+s)S(Q). \tag{9}$$

National welfare of country $H$ is defined to be the sum of producer surplus of the export industry and tax revenue, given as

$$\begin{aligned} W^H &= sS(Q)Q+S(Q)Q-\int_0^Q S(q)\mathrm{d}q \qquad (10)\\ &= P(Q)Q-\int_0^Q S(q)\mathrm{d}q. \end{aligned}$$

Note that equation (9) is utilized to simplify $W^H$. Since $Q$ is a function of an ad valorem tax rate, optimal tax rate is obtained by solving the first-order condition for welfare maximization:

$$(\mathrm{d}W/\mathrm{d}s)=[P'Q+P-S](\mathrm{d}Q/\mathrm{d}s)=0. \tag{11}$$

Note that equation (11) is equivalent to equation (8). Thus, we obtain:

**PROPOSITION 2** The optimal competition policy for export marketing boards is equivalent to the optimal export tax policy in that both policies can achieve the same level of national welfare.

Evidently, what can be achieved by optimal export tax can be achieved through optimal competition policy and vice versa.[5] It is easy to verify that proposition 2 is also

5) In reality, due to an integer constraint, the optimal competition policy is an imperfect substitute for the optimal export tax policy. Moreover, there could be a major difference in terms of the distribution of national welfare, since marketing board profits go to the particular agencies, whereas revenues from export taxes accrue to the government for eventual redistribution. However, with suitable redistributive policies of the government, the two policies can be equivalent to each other in terms of distribution of national welfare as well.

valid when specific export tax is imposed instead of ad valorem tax. In fact we could think of a large number of policies which would be equivalent to the optimal competition policy.

As the optimal competition policy is equivalent to the optimal tax policy, one might surmise that there exist certain relationship between them. Indeed this is the case. To see the relationship between them, define $e^d$ and $e^s$ to be foreign import demand and home export supply elasticities, respectively. That is, $e^d = -[(dQ/dP(Q))\ (P(Q)/Q)]$ and $e^s = [(dQ/dS(Q))(S(Q)/Q)]$. Also, let $s^*$ denote the optimal ad valorem export tax rate. Then, by (9), $S(Q^*) = P(Q^*)/(1+s^*)$. Inserting $S(Q^*)$ into (11) and arranging terms, we obtain the well-known relationship between $s^*$ and $e^d$, $s^*=1/(e^d-1)$. Corollary 1 expresses proposition 1 in terms of $e^d$, $e^s$, and $s^*$.

**COROLLARY 1** The optimal number of export marketing boards, $n^*$, is given as $n^*=1+1/(e^s s^*)=(e^d+s^s-1)/s^s$, where $e^d$ and $e^s$ are evaluated at $Q^*$.

**proof** By (9), it follows that $P(Q^*)=(1+s^*)S(Q^*)$. Utilizing this and definitions of elasticities, $n^*$ is calculated as

$$n^*=1-(S'(Q^*)/P'(Q^*)) = 1+[e^d/e^s]\,[(S(Q^*)/P'(Q^*))] \quad (9)$$
$$=1+[(e^d/e^s)]\,[1/(1+s^*)].$$

Since $s^*=1/(e^d-1)$, Corollary 1 follows. Q.E.D.

Corollary 1 can easily be interpreted. The larger the elasticity of the import demand is, the smaller is the extent to which export marketing boards exploit their market power. Then, the home exporting country is better-off with a large number of boards. A similar argument applies to the relationship between $n^*$ and the elasticity of the export supply. Thus, the smaller the elasticity of the export supply is, the larger is the optimal number of export marketing boards.

## Ⅲ. Cartels vs. Tariffs

In the previous section we have derived the optimal number of export marketing boards when the government of the exporting country unilaterally intervenes in international trade. As in Brander and Spencer [2], we now introduce the possibility of interaction of trade and competition policy between governments of the exporting and the importing countries. The strategy variable of the home exporting country is the competition policy toward export marketing boards. The foreign importing country sets specific or ad valorem import tariff.

A noncooperative Nash equilibrium of policy interaction between the two governments is achieved when each government maximizes its own national welfare with respect to its own strategy variable, taking as given the level of the other country's strategy. When country $F$ imposes a specific import tariff, the relationship between the optimal number of export marketing boards and demand and supply curves derived in proposition 1 is not affected. This can be explained as follows. The effect of specific import tariff is, from export marketing boards point of view, equivalent to a parallel downward movement of the "effective" import demand curve by the amount of the tariff. The slope of the "effective" import demand curve at each quantity remains the same. Thus, proposition 1 is still valid. However, if country $F$ levies an ad valorem tariff, the relationship derived in proposition 1 should be revised. Suppose that the foreign government collect $tP(Q)$, out of per-unit price $P(Q)$, as per-unit tariff revenue. Let $t^N$ denote Nash equilibrium ad valorem import tariff rate of the foreign country. Then, the "effective" unit price to export marketing boards is given as $(1-t^N)P(Q)$. At the Nash equilibrium of policy interaction, the following result holds.

**PROPOSITION 3** (1) When the importing country imposes specific import tariff, the Nash equilibrium number of export marketing boards is given by $n^*=1-(S'(Q^*)/P'(Q^*))$. (2) When the importing country imposes ad valorem import tariff, the Nash equilibrium number of export marketing boards is given as $n^*=1-S'(Q^*)/[(1-t^N)P'(Q^*)]$, where $t^N$ denotes the Nash equilibrium tariff rate of the importing country.

Note that ad valorem import tariff changes the relationship between the optimal number of export marketing boards and slopes of demand and supply curves, while the relationship derived in proposition 1 is valid in case of specific tariffs. The ad valorem tariff tends to increase the optimal number of export marketing boards. When demand and supply curves are linear, ad valorem tariff definitely increases $n^*$.

## Ⅳ. Competition Policy for Import Marketing Boards

We now consider the optimal competition policy of the foreign country for import marketing boards. As in sections 2 and 3, $P(Q^*)$ denotes the (inverse) import demand of country $F$, while $S(Q)$ denotes export supply of country $H$. The government of country $F$ assigns "licenses to import" to a few number of trading corporations. Each license holder can import the product without any quantity restriction. Note that this policy is different from import quota in that no restriction is imposed on quantity each board can import. Each board is assumed to be a profit-maximizing Cournot-Nash competitor. No cost is associated with marketing activity of import marketing boards. Import board $i$'s profit $\Pi^i$ obtained by selling $q_i$ is calculated as

$$\Pi^i = [P(Q) - S(Q)]q_i. \qquad (1)'$$

The first-order condition for profit maximization is given as

$$(\partial\Pi^i/\partial q_i) = P + P' q_i - S - S' q_i = 0. \qquad (2)'$$

As in equation (3), summation of the first order condition over $i=1, \cdots, n$, gives

$$\sum_i(\partial\Pi^i/\partial q_i) = nP + P' Q - nS - S' Q = 0. \qquad (3)'$$

Equation (3)$'$ gives the import volume $Q$ as a function of the number of import marketing boards. Conditions (4) and (5) are again assumed to be satisfied. Then, $Q$ is an increasing function of $n$. That is, import volume increases as the number of import marketing boards increases.

The government of country $F$ can affect import volume by changing the number of licenses to import. We now examine the optimal competition policy of the government of country $F$. National welfare of country $F$ is assumed to be the sum of consumer surplus and profits of the import marketing boards:

$$W^F = \int_0^Q P(q)\mathrm{d}q - P(Q)Q + [P(Q) - S(Q)]Q$$
$$= \int_0^Q P(q)\mathrm{d}q - S(Q)Q.$$

Let $Q^*$ denote the import volume corresponding to $n^*$. Following the similar procedure as in section 2, we obtain:

**PROPOSITION 4** (1) If the export supply curve is upward-sloping, the optimal number of import marketing boards is given as one plus the ratio of the absolute slope of the import demand curve relative to the slope of the export supply curve. That is, $n^*=1-(P'(Q^*)/S'(Q^*))$. (2) If the export supply curve is horizontal so that $S'=0$, then the optimal number of import marketing boards is infinity.

Though $n^*$ is not explicitly given, proposition 4 reports an important result with respect to the optimal competition policy. The objective of the government of country $F$ is to maximize the sum of direct profits of import marketing boards and consumer surplus. The steeper the demand curve is, or the flatter the export supply curve is, the more importance consumer surplus gains relative to direct profits of the import marketing boards. Thus, the optimal number of import marketing boards is larger.

As in section Ⅱ, the optimal number $n^*$ can be expressed in terms of elasticities of import demand and export supply, and the optimal import tariff rate $t^*$.

**COROLLARY 2** The optimal number of import marketing boards, $n^*$, is given as $n^*=(1+t^*)(e^s/e^d)+1=(e^d+e^s+1)/e^d$, where $e^d$ and $e^s$ are evaluated at $Q^*$.

The larger the elasticity of the export supply, and the smaller the elasticity of import demand is, the larger is the optimal number of import marketing boards.

## V. Concluding Remarks

This paper has derived optimal competition policy for export and import marketing boards, respectively. It is shown that the optimal competition policy for export and import marketing boards is equivalent to export tax and import tariff policy, respectively. The optimal number of export marketing boards proves to be one plus the ratio of the slope of the export supply curve relative to the slope of the import demand curve. The optimal number of import marketing boards turns out to be one plus the ratio of the slope of the import demand curve relative to the slope of the export supply curve.

These results hold for general demand and supply conditions. The optimal numbers of marketing boards are also expressed in terms of elasticities of import demand and export supply and optimal trade taxes.

With a slight modification, the model developed in this paper can be applied to analyze the cases in which firms of an oligopolistic export industry interact with each other in their domestic factor markets as well as in international output market. When the unit production cost net of factor cost is constant, the analysis of this paper can be directly applied to such a case.[6)]

This paper may be extended in several directions. An interesting extension is to consider the possibility of simultaneous implementation of trade tax policy and competition policy by the exporting country. The possibility of interaction of competition policy between governments may also raise several interesting issues.

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