Endogenous Trade Policies and GATT Rules

Katsuhiko Suzuki

I. Introduction

The purpose of this paper is to show that an export subsidy implemented non-cooperatively by a country exporting a good improves world welfare by reducing the distortion created by an import tariff levied non-cooperatively by a country importing the same good in a two-country two-good two-factor general equilibrium model combined with the political contributions approach to protection developed by Grossman and Helpman (1994, 1995)[1]. There have been several papers that have explored the welfare-improving effects of export subsidies in partial equilibrium models[2]. Brander and Spencer (1985) show that if domestic and foreign oligopoly firms export independently and non-cooperatively a homogeneous good to a third-country market, the optimal trade policy for the domestic government to maximize its national welfare is an export subsidy. Bagwell and Staiger (2001) indicate that if domestic and foreign competitive firms export a homogeneous good to a third-country market, and if each government has a sufficiently strong political motivation to enhance the welfare of its export sector, then the optimal trade policy is an export subsidy[3]. However, there are no papers that deal with the issue in a general equilibrium framework. This paper is an attempt to fill the gap in the literature of this field.

According to the political-contributions approach to protection, trade policy measures of a country are determined in a political equilibrium between lobby groups that demand import protection or export encouragement from the government and the government that needs votes from the citizens and political contributions for campaign funds from the lobby groups during elections. In a laissez-faire case where tariffs and export subsidies are available as trade policy measures, the equilibrium policy measure is, according to this approach, an import tariff in a country importing a good and an export subsidy in a country exporting the same good if each government places comparatively light emphasis on the national welfare relative to import restriction or export encouragement. As a result, the local prices of the good rise both in the importing and exporting countries. In an interference case where export subsidies are prohibited but tariffs are allowed as trade policy measures, the equilibrium policy measure becomes a zero tariff on exports (that is, free trade) in the exporting country while it is invariably an import tariff in the importing country. Therefore, the distortion caused by the inter-country disparity in the local price is smaller in the laissez-faire case (hereinafter, l-f case) than in the interference case (hereinafter, i-r case) because a rise in the importer's local price due to the tariff is partly or wholly offset by a rise in the exporter's local price due to the export subsidy in the l-f case but not in the i-r case. If the economic welfare of each country is measurable and countable, the level of world welfare can be represented by a weighted average of the two countries' levels of welfare. It is maximized when the local prices are internationally equal and decreasing together with the volume of the international trade in goods as the disparity between them expands. Therefore, we can conclude that the level of world welfare and the volume of trade in goods are greater in the l-f case than in the i-r case.

These conclusions have interesting implications for the performance of the GATT (General Agreement on Tariffs and Trade) and its successor, the WTO (World Trade Organization). The GATT/WTO intends to improve world welfare by making general rules on trade policies[4]. For example, it has rules whereby tariffs are allowed but export subsidies for non-primary goods are prohibited as trade policy measures[5]. If the two countries concerned here are members of WTO, and if one of the two goods taken up here is a non-primary product, then we may regard the l-f case as the regime prevailing prior to the GATT being established (hereinafter, p-G regime) and the i-r case as the regime prevailing under the GATT/WTO (hereinafter, G/W regime). Therefore, the conclusions stated above imply that a transition of the member countries from the p-G to the G/W regime reduces the volume of trade in goods and the level of world welfare if the subsidized good is a non-primary product. This serves to explain the paradoxical results obtained by Rose (2004) that the GATT/WTO does not systematically contribute to the expansion of trade by its member countries. It also suggests that the GATT rule of prohibiting export subsidies for non-primary products is inconsistent with its objective of improving the level of world welfare.

The composition of this paper is as follows. The 2x2x2 model is presented in section II. Section III introduces the framework for the political contributions approach. Section IV discusses how a country's equilibrium policy measures respond to a change in the trading partner's policy measures and explores how the Nash equilibrium between the two countries depends on weight a government places on national welfare relative to political contributions. Section V defines the level of world welfare to explore the effects on it of the two countries' shift from the l-f to the i-r case. Conclusions are presented in section VI.

II. The Specific-Factor Model

There are two countries in the world, home and foreign, and two goods, goods 1 and 2, are produced in each country. Good 2 is used as a numeraire good. Suppose that an individual obtains satisfaction by consuming goods 1 and 2, and that the level of satisfaction, u, is measured with a utility function of additively separable type

$$u = D_1^e + D_2 \qquad 0 < e < 1, \tag{1}$$

where D_i denotes the individual's consumption of good i ($i = 1, 2$), and e is a positive number less than one[6]. Solving the constrained utility-maximization problem yields his/her demand function for good 1, $D_1 = (p/e)^\eta$, where p denotes the price of good 1 in terms of good 2, and η is the price elasticity of its demand and equal to $-1/(1-e)$, a negative number less than -1. At the same time, the demand function for the numeraire good is derived as $D_2 = I - p(p/e)^\eta$, where I denotes the individual's income. Substituting these demand functions into utility function (1) leads to the indirect utility function, $v = I + S$, where S denotes the consumer's surplus obtained by the consumption of good 1. Attaching affix * to a variable of the foreign country to distinguish it from that of the home country and assuming that the utility function is internationally identical, we can obtain the foreign individual's demand function for good 1: $D_1^* = (p^*/e)^\eta$.

Suppose that good 1 is produced with labor and sector-specific capital and that the technology is subject to constant returns to scale and is different between the two countries. Then this good is referred to as a capital-using good, and its production functions are represented for the domestic and foreign countries, respectively, by

$$X_1 = H(K, L_1) = L_1 h(k_1) \quad \text{and} \quad X_1^* = F(K^*, L_1^*) = L_1^* f(k_1^*), \tag{2-a}$$

where X_i, L_i, K and k_1 denote the output of good i, the input of labor required to produce X_i ($i = 1, 2$), the input of capital required to produce X_1, and the capital-labor input ratio of good 1, respectively. It is specifically assumed that the production functions are different in the Harrod neutral sense and that there is some positive constant γ such that $h(k_1) = \gamma f(k_1/\gamma)$ and if $r_1 = h'(k_1) = f'(k_1^*)$, then $k_1 = \gamma k_1^*$ and $w/p = h(k_1) - k_1 h'(k_1) = \gamma[f(k_1^*) - k_1^* f'(k_1^*)] = \gamma w^*/p^*$. Then the domestic function in (2-a) can be rewritten as: $X_1 = \gamma L_1 f(k_1/\gamma)$. If $K = K^*$ and $H(K, L_1) = F(K^*, L_1^*)$, then $\gamma = L_1^*/L_1$, indicating that γ represents the efficiency of domestic labor relative to foreign labor (hereinafter referred to the "domestic-labor-efficiency ratio"). Thus, for this efficiency ratio the following assumption is made:

Assumption 1: $\gamma \geq 1$.

This means that domestic labor is not less efficient than foreign labor in sector 1. The specification of technological difference does not influence the conclusions obtained below in the sense that the same conclusions can be obtained under another specification where the production functions of this sector are internationally different in the Hicks neutral sense. Good 2 is produced with labor alone by technology with a labor-input coefficient equal to one. Then its domestic and foreign production functions are respectively represented by $X_2 = L_2$ and $X_2^* = L_2^*$. Thus labor is a general factor used for the production of the two goods.

Product as well as factor markets are perfectly competitive in each country. Profit maximization conditions for competitive firms with positive outputs are represented in domestic and foreign sector 1, respectively, by

$$w = \gamma p[f(k_1/\gamma) - (k_1/\gamma) f'(k_1/\gamma)] \quad \text{and} \quad w^* = p^*[f(k_1^*) - k_1^* f'(k_1^*)] \tag{3}$$

and

$$r_1 = f'(k_1/\gamma) \quad \text{and} \quad r_1^* = f'(k_1^*), \tag{4}$$

where w denotes the wage rate in terms of good 2, and r_1 the rental measured with good 1 while $f'(k_1^*)$ represents the first derivative of function $f(k_1^*)$. It is assumed that the marginal product of capital is positive and monotonically decreasing as the capital-labor input ratio of good 1 increases. The corresponding conditions for domestic and foreign sector 2 generate the results, $w = w^* = 1$, implying that good 2 is produced in both countries for any nonnegative value of p (p^*). The conditions in (4) imply that r_1 (r_1^*) depends only on γp (p^*) because k_1/γ (k_1^*) is a monotonically decreasing function in γp (p^*), as shown by

$$\hat{k}_1 - \hat{\gamma} = -\sigma_K(\gamma p)(\hat{p} + \hat{\gamma}) \quad \text{and} \quad \hat{k}_1^* = -\sigma_K(p^*)\hat{p}^*, \tag{5}$$

where a variable with a circumflex over the top denotes its relative change, for instance $\hat{k}_1 = dk_1/k_1$, and the elasticities are represented, respectively, by $\sigma_K(\gamma p) = -\gamma[pk_1^2 f''(k_1/\gamma)]^{-1}$ and $\sigma_K(p^*) = -[p^* k_1^{*2} f''(k_1^*)]^{-1}$. If $k_1 = \gamma k_1^*$, or equivalently $p^* = \gamma p$, then $\sigma_K(\gamma p) = \sigma_K(p^*)$. Labor and capital are fully employed in both countries. These conditions are respectively represented under the assumption that they are immobile between the countries:

$$L_1 + L_2 = L, \quad L_1^* + L_2^* = L^*, \quad K = \bar{K}, \quad \text{and} \quad K^* = \bar{K}^*, \tag{6}$$

where L and $\bar{K}$ denote the fixed volumes of labor supply and capital stock in the home country, respectively.

In order to express all variables on the per capita basis, it is assumed that the number of individuals is equal to the labor endowment in each country. Then the per capita outputs of the capital-using good can be represented for the home and foreign countries, respectively, by

$$x_1 = \gamma k f(k_1/\gamma)/k_1 \quad \text{and} \quad x_1^* = k^* f(k_1^*)/k_1^*, \tag{7}$$

where x_i denotes the per capita output, X_i/L ($i = 1, 2$), and k the per capita input of capital, K/L. Let $\delta(\gamma p)$ and $\delta(p^*)$ denote the supply elasticities of good 1 in the home and foreign countries, respectively. Then the relative changes in the per capita output of good 1 are represented for the home and foreign countries, respectively, by

$$\hat{x}_1 = \delta(\gamma p)(\hat{p} + \hat{\gamma}) + \hat{k} \quad \text{and} \quad \hat{x}_1^* = \delta(p^*)\hat{p}^* + \hat{k}^*, \tag{8}$$

where $\delta(\gamma p) = [1 - \alpha(\gamma p)]\sigma_K(\gamma p)$ and $\delta(p^*) = [1 - \alpha(p^*)]\sigma_K(p^*)$. In these expressions, $\alpha(\gamma p)$ and $\alpha(p^*)$ denote the distributive shares of capital in the domestic and foreign sector 1, respectively. It should be noted that $\delta(\gamma p)$ and $\delta(p^*)$ are independent of k and

k^*, respectively, and that if $k_1 = \gamma k_1^*$, $\delta(\gamma p) = \delta(p^*)$. If the production function of sector 1 is of the Cobb Douglas type, it is represented for the home and foreign countries, respectively, by

$$X_1 = K^\alpha (\gamma L_1)^{1-\alpha} \quad \text{and} \quad X_1 = K^\alpha (\gamma L_1)^{1-\alpha}, \qquad 0 < \alpha < 1, \tag{2-b}$$

where α is a constant. Then (7) can be reduced to $x_1 = [\delta\gamma p/(1+\delta)]^\delta k$ and $x_1^* = [\delta p^*/(1+\delta)]^\delta k^*$, respectively, where $\delta = \delta(\gamma p) = \delta(p^*) = (1-\alpha)/\alpha$. The requirement that the two goods must be produced in each country determines the feasible ranges of p and p^*:

$$0 < p < [\gamma(f(k/\gamma) - kf'(k/\gamma))]^{-1} \quad \text{and} \quad 0 < p^* < [f(k^*) - k^* f'(k^*)]^{-1}, \tag{9}$$

because the wage rate is equal to one in each country, $f(k_1) - k_1 f'(k_1)$ is an increasing function in k_1, and k_1 and k_1^* are smaller than k and k^*, respectively, under the requirement.

Suppose that the home country exports the capital-using good, and that the income distribution policy measure available to it is an ad valorem export subsidy or tariff for this good. The domestic government pays the subsidies or receives the revenues, $B = (\tau - 1)qm_1$, where $\tau = 1 + t$, t is a subsidy rate ($t > 0$) or tariff rate ($t < 0$), m_1 $(= D_1 - x_1)$ denotes the exports of this good when $m_1 < 0$, and q represents its world price in terms of the numeraire good, respectively. Then its local price in the home country is represented by $p = \tau q$. It is assumed that the government collects the subsidy payments from the individuals using a head tax or it distributes the tariff revenues to them using a head subsidy. Then the domestic per capita welfare, W, is represented by

$$W = 1 + B + S + pr_1 k, \tag{10-a}$$

where the first term in the RHS of (10-a) represents the wage rate, and the last term represents the per capita rent for capital. It is also assumed that the foreign country imports the capital-using good, and that the income distribution policy measure available to it is an ad valorem import tariff or subsidy for this good. The foreign government receives the revenues or pays the subsidies, $B^* = (\tau^* - 1)qm_1^*$, where m_1^* $(= D_1^* - x_1^*) > 0$, $D_1^* \equiv D_1(p^*)$, $x_1^* \equiv x_1(p^*)$, $\tau^* = 1 + t^*$, and t^* is a tariff rate ($t^* > 0$) or a subsidy rate ($t^* < 0$). Then the local price of good 1 in this country is given as $p^* = \tau^* q$. It is assumed that the revenues are redistributed to and the payments collected from the foreign individuals on an equal, per capita basis by their government. Then the foreign per capita welfare, W^*, is represented by

$$W^* = 1 + B^* + S^* + p^* r_1^* k^* . \qquad (10\text{-b})$$

The government of each country cannot pay the subsidy indefinitely. Its upper limit is the benefits that the subsidy policy creates directly and indirectly and is represented by the sum of the consumers' surplus, capital rewards and wages. Thus the following assumption is made:

Assumption 2: The subsidy payment by the government of each country must be within the sum of its consumers' surplus, capital rewards and wages: $-B \le S + pr_1 k + 1$ and $-B^* \le S^* + p^* r_1^* k^* + 1$.

This is equivalent to assuming that the per capita welfare is not negative in each country. The sufficient conditions for the policy measures to satisfy Assumption 2 are:

$$\tau \ge 1 + 1/\eta \qquad \text{and} \qquad \tau^* \ge 1 + 1/\eta , \qquad (11)$$

because the requirement, $W \ge 0$, can be rewritten as $qD_1(\tau\eta/(1+\eta) - 1) + qx_1 + (k_1 - k)/k_1 \ge 0$ by virtue of (3) and (4). The requirement, $W^* \ge 0$, can be rewritten as the counterpart in terms of the corresponding foreign variables. Conditions (11) represent the feasible ranges of policy measures implemented by the home and foreign governments, respectively.

The trade pattern of the two countries limits the feasible ranges of p and p^*, respectively, to $p > ex_1^{1/\eta}$ and $p^* < ex_1^{*1/\eta}$. These expressions can be rewritten using (8) as

$$p > 1/\mathrm{K}(\gamma, k) \qquad \text{and} \qquad p^* < 1/\mathrm{K}(k^*) ,$$

where the partial elasticities of K with respect to γ, k and k^* are represented, respectively, by $(\gamma/\mathrm{K})(\partial \mathrm{K}/\partial\gamma) = \delta(\gamma p)/[\delta(\gamma p) - \eta]$, $(k/\mathrm{K})(\partial \mathrm{K}/\partial k) = 1/[\delta(\gamma p) - \eta]$, and $(k^*/\mathrm{K})(\partial \mathrm{K}/\partial k^*) = 1/[\delta(p^*) - \eta]$. It is assumed that good 1 is produced in both countries even when $m_1 = m_1^* = 0$. This implies that $0 < 1/\mathrm{K}(\gamma, k) < 1/[\gamma(f(k/\gamma) - kf'(k/\gamma))]$ and $0 < 1/\mathrm{K}(k^*) < 1/[f(k^*) - k^* f'(k^*)]$. Therefore, the feasible ranges of p and p^*, within which the production is diversified and the trade pattern is maintained in each country, are represented, respectively, by

$$1/\mathrm{K}(\gamma, k) < p < 1/[\gamma(f(k/\gamma) - kf'(k/\gamma))] \quad \text{and} \quad 0 < p^* < 1/\mathrm{K}(k^*). \tag{12}$$

It should be noted that $m_1 = 0$ when $p = 1/\mathrm{K}(\gamma, k)$, and $m_1^* = 0$ when $p^* = 1/\mathrm{K}(k^*)$. Tariff-subsidy ratio τ^*/τ plays an important role in the following argument because the local prices of good 1 are zeroth degree homogeneous functions in τ and τ^* as shown in (16) and (17) below. Thus we need to know its feasible range. This can be derived from (12) as

$$0 < \tau^*/\tau < UPL, \tag{13}$$

where $UPL = \mathrm{K}(\gamma, k)/\mathrm{K}(k^*)$. Provided γ, k and k^* are fixed, the UPL is constant. If the sector-1 production function is of the Cobb-Douglas type shown in (2-b), it is reduced to $(\gamma^\delta k/k^*)^{1/(\delta-\eta)}$. The home country must be relatively abundant in capital in order for the trade patterns of the two countries to be ensured, even if $\gamma = 1$. Thus the following assumption is made:

Assumption 3: $k > k^*$.

The equilibrium prices of the capital-using good are determined in terms of the exogenous variables τ, τ^*, γ, k and k^* by the world market-clearing condition:

$$\rho m_1(p, \gamma, k) + (1-\rho) m_1^*(p^*, k^*) = 0 \quad , \tag{14}$$

where ρ denotes the share of domestic fixed labor supply in the world total, $L^w = L + L^*$. Using the relative changes in the exports and imports of good 1, $\hat{m}_1 = \varepsilon \hat{p} - (x_1/m_1)(\delta(\gamma p)\hat{\gamma} + \hat{k})$ and $\hat{m}_1^* = -\varepsilon^* \hat{p}^* - (x_1^*/m_1^*)\hat{k}^*$, we can represent the relative changes in q, p and p^*, respectively, by

$$\hat{q} = -\frac{1}{\varepsilon+\varepsilon^*}(\varepsilon\hat{\tau}^* + \varepsilon^*\hat{\tau}) + \frac{1}{\varepsilon+\varepsilon^*}\left(\frac{x_1}{m_1}(\delta(\gamma p)\hat{\gamma} + \hat{k}) - \frac{x_1^*}{m_1^*}\hat{k}^*\right), \tag{15}$$

$$\hat{p} = -\frac{\varepsilon^*}{\varepsilon+\varepsilon^*}(\hat{\tau}^* - \hat{\tau}) + \frac{1}{\varepsilon+\varepsilon^*}\left(\frac{x_1}{m_1}(\delta(\gamma p)\hat{\gamma} + \hat{k}) - \frac{x_1^*}{m_1^*}\hat{k}^*\right) \tag{16}$$

and

$$\hat{p}^* = \frac{\varepsilon}{\varepsilon+\varepsilon^*}(\hat{\tau}^* - \hat{\tau}) + \frac{1}{\varepsilon+\varepsilon^*}\left(\frac{x_1}{m_1}(\delta(\gamma p)\hat{\gamma} + \hat{k}) - \frac{x_1^*}{m_1^*}\hat{k}^*\right). \tag{17}$$

In these equations, ε and ε^* denote the price elasticities of domestic exports and foreign imports of good 1, $\varepsilon = (D_1\eta - x_1\delta(\gamma p))/m_1$ and $\varepsilon^* = (x_1^*\delta(p^*) - D_1^*\eta)/m_1^*$, respectively. They satisfy conditions, $\varepsilon > \delta(\gamma p)$ and $\varepsilon^* > -\eta$, respectively. With the balance of trade condition for each country, condition (14) simultaneously brings about the equilibrium of the world market for good 2. It is obvious from (15) ~ (17) that the world price of good 1 is a minus oneth degree homogeneous function while each local price of this good is a zeroth degree homogeneous function in τ and τ^*. The world price of this good falls as the level of each policy measure is raised and a country's capital endowment increases. This is because all of these changes in the parameters create an excess supply of this good in the world market.

Ⅲ. Special Interest Groups and the Government

In this section, we consider how the level of trade policy measure is determined in the non-cooperative Nash equilibrium between the owners of capital and the government in each country by following the political contributions approach to protection developed by Grossman and Helpman (1994, 1995). This is performed separately for the two institutional conditions of trade introduced in Section I; the l-f case, where tariffs and export subsidies are available as trade policy measures, and the i-r case, where export subsidies are banned but tariffs are allowed. It is assumed that all parties participating in the political negotiation to determine trade policy measures regard as given the institutional conditions for trade.

A. The laissez-faire case

As in the previous section, it is assumed that there are no other income distribution policies except trade policies for subsidies and tariffs and that the participants in the political negotiations are only concerned with income distribution. The owners of capital demand that their government encourage export of the capital-using good in the home country and the protection of the industry producing this good at home in the foreign country because they know that capital reward increases as p (p^*) is raised. In return, they are willing to make political contributions to their own governments, the amount of which depends on the levels of implemented policy measures. For these purposes, they form a lobby group in each country. The lobby group in the home country (foreign country) petitions the government to increase the export subsidy (import tariff) and promises the governing party that it will make political contributions, C (C^*), the amount of which depends on the level of the implemented policy measure. Anticipating this level, the lobby group decides simultaneously and non-cooperatively the amount of contributions to maximize its net welfare, V (V^*), taking as given the contribution schedule of the trading partner's lobby group. Its net welfare is equal to the difference between the total reward of capital and the contributions and represented as differentiable functions in the home and foreign countries, respectively, by

$$V = pr_1\bar{K} - C, \qquad \text{and} \qquad V^* = p^* r_1^* \bar{K}^* - C^*. \tag{18}$$

High government officials who hope to win the next election expect votes from the individuals and campaign funds from the lobby group. For this purpose, the government in each country intends to increase the per capita welfare and raise the level of trade policy measure in accordance with the demand from the domestic lobby group. However, an increase in the level of export encouragement or industry protection leads to a decline in the welfare of the individuals, so that it is crucial for the government to determine which is more important, welfare or political contributions. I denote by π the weight that a government puts on the former compared with the latter (hereinafter designated as the "welfare weight"), and assume that it is continuous and identical across countries. Give contribution schedule of the lobby group, the government determines simultaneously and non-cooperatively the policy measure level so as to maximize its objective function, taking as given the level of the policy measure implemented by the trading partner's government. Its objective function for the home country (foreign country), G (G^*), is the weighted sum of the welfare and the contributions paid by the lobby group and represented as differentiable functions, respectively, by

$$G = C + \pi LW \quad \text{and} \quad G^* = C^* + \pi L^* W^*. \tag{19}$$

[Figure 1 here]

The political equilibrium can be depicted and analyzed in each country using indifference maps for the lobby group's net welfare and the government's objective function. For a given set of the welfare weight, the domestic-labor-efficiency ratio, and the per capita capital endowment, the indifference curve of V is upward sloping in the (τ, C) coordinate plane because its slope derived from (18) is shown by

$$\left.\frac{dC}{d\tau}\right|_{\bar{V}} = \frac{\partial V}{\partial \tau} = \frac{qX_1\varepsilon^*}{\varepsilon+\varepsilon^*} > 0 .$$

It is assumed that $\partial^2 V/\partial\tau^2 < 0$. Then the set of the indifference curves can be depicted as the curves V^0V^0 and $V^0V^0{}'$, as shown in Fig.1. Clearly, the level of the indifference curve goes up as a higher level of policy measure is implemented for a given C. The indifference curve of G can also be depicted for a given value of the exogenous variables in the figure. Its slope is derived from (10-a) and (19) as

$$\left.\frac{dC}{d\tau}\right|_{\bar{G}} = -\frac{\pi L\partial W}{\partial \tau} = -\frac{\pi qLm_1\varepsilon\left\{(\tau-1)\varepsilon^*+1\right\}}{\tau(\varepsilon+\varepsilon^*)} .$$

In deriving this equation, the relationship, $\sigma_{\alpha p} = (1-\alpha(\gamma p))/\alpha(\gamma p) - \delta(\gamma p)$ is used, where $\alpha(\gamma p)$ denotes the distributive share of capital in sector 1 and $\sigma_{\alpha p}$ its partial elasticity with respect to p. The slope is negative at the minimum value of τ that satisfies Assumption 2 but positive at $\tau = 1$. It becomes steeper as τ is raised above one, implying that the indifference curve has its lowest point at some export-tariff rate. There will exist an indifference curve, the lowest point of which comes just on the horizontal axis because its level continuously increases as C is raised for a given τ. Such an indifference curve and its lowest point are depicted respectively as G^0G^0 and (τ^{00}, 0) in the figure. It may be noted that τ^{00}, which equals $1-1/\varepsilon^*$, is the equilibrium policy measure implemented by the government in the case where there are no lobby activities.

The domestic government can attain level G^0 of its objective function without any political contributions, so that it does not accept a level lower than G^0. Therefore, G^0 is the reservation level of the objective function. Under such a situation, the optimum behavior of the domestic lobby group is to offer a contribution equal to C^0 and to induce the government to set τ^0, as indicated by its indifference curve tangent to G^0G^0. This means in Fig. 1 that point A, the coordinates of which are (τ^0, C^0), is the equilibrium point between the lobby group and the government. Reaching this point is equivalent to the behavior of the lobby group to solve implicitly the problem of maximizing V by controlling C under constraints $C + \pi LW \geq G^0$, $\tau \geq 1 + 1/\eta$, and $C \geq 0$. Therefore, the political equilibrium trade policy measure is represented by

$$\tau^0 = \arg\max[pr_1\bar{K} + \pi LW], \tag{20}$$

which maximizes the joint welfare of the lobby group and the government. It can be derived by solving (20) as a function of τ^{*0} and π at a given set of relative capital endowments.

$$\tau^0(\tau^{*0},\ \pi) = \tau^{00}\left[1 + x_1/(\pi\varepsilon m_1)\right]^{-1}. \tag{21}$$

This expression shows that the equilibrium level of the domestic policy measure is a product of a trade interference due to the terms of trade motive τ^{00} and a trade interference due to the income redistribution motive $\left[1 + x_1/(\pi\varepsilon m_1)\right]^{-1}$. That this interference must not be negative is a necessary and sufficient condition for the policy measure to be feasible and it is equivalent to the requirement that the welfare weight must lie in the following range,

$$\pi > \pi_L. \tag{22}$$

where π_L denotes the lower limit of π that makes τ^0 feasible, and it is represented by $\pi_L = -x_1/(\varepsilon m_1)$. The equilibrium policy measure is an export subsidy or tariff for a welfare weight lying in (22). It is a decreasing function in the weight under the *ceteris paribus* condition and exceeds τ^{00}, which is greater than $1 + 1/\eta$. This policy measure and the counterpart of the foreign country shown in (23) below are the special cases of Grossman and Helpman (1994) proposition 2 in the sense that interest group members account for a negligible fraction of the total voting population.

The equilibrium level of a policy measure for the foreign country is also determined as a function in τ^0 and π at a given set of relative capital endowments. It is represented by

$$\tau^{*0}(\tau^0, \pi) = \tau^{*00}\left[1 - x_1^*/(\pi\varepsilon^* m_1^*)\right]^{-1}, \tag{23}$$

where τ^{*00}, which equals $1 + 1/\varepsilon$, denotes the equilibrium policy measure implemented by the foreign government in the case where there are no lobby activities. It should be noted that the minimum point of the indifference curve for the government's objective function lies on the horizontal τ^*-axis to the right of the vertical line $\tau^* = 1$. Expression (23) shows that it is, like the counterpart of the home country, divided into trade interferences due to the terms of trade motive and the income redistribution motive. The latter, $\left[1 - x_1^* / (\pi\varepsilon^* m_1^*)\right]^{-1}$, is nonnegative, and hence the foreign policy measure is feasible if and only if $\pi > \pi_L^*$, where π_L^* denotes the lower limit of π that makes τ^{*0} feasible and is represented by $\pi_L^* = x_1^* / (\varepsilon^* m_1^*)$. For the two lower limits of feasible weights, the following assumption is made:

Assumption 4: $\pi_L^* < \pi_L$.

This assumption means that the foreign equilibrium policy measure is feasible where the welfare weight is not heavier than the weight given to the domestic equilibrium policy measure. It is equivalent to assuming that $x_1 / (\varepsilon m_1) + x_1^* / (\varepsilon^* m_1^*) < 0$, and is always satisfied when the production functions of good 1 are of the Cobb-Douglas type shown in (2-b). The policy measures for the home and foreign countries are both feasible for a welfare weight satisfying (22) under Assumption 4. Thus, π_L can be designated as the lower limit of feasible weights. The equilibrium policy measure of the foreign country is an import tariff as long as it is feasible. It is greater than τ^{*00}, lies in the feasible range shown by (11), and is a decreasing function in the weight under the *ceteris paribus* condition.

Assumption 4 also implies that the equilibrium tariff-subsidy ratio τ^{*0} / τ^0 is an increasing function in a welfare weight under the *ceteris paribus* condition. This can be shown by the following relationship derived from (21) and (23):

$$\frac{\tau^{*0}(\tau^0,\ \pi^*)}{\tau^0(\tau^{*0},\ \pi)} = \left[1 + \frac{x_1 / (\varepsilon m_1) + x_1^* / (\varepsilon^* m_1^*)}{\pi - x_1^* / (\varepsilon^* m_1^*)}\right]\left(\frac{\tau^{*00}}{\tau^{00}}\right). \tag{24}$$

In this expression the numerator of the second term in the parentheses on the RHS is negative under Assumption 4. The equilibrium tariff-subsidy ratio approaches zero as a weight approaches π_L, whereas it approaches ratio τ^{*00} / τ^{00} as a weight approaches infinity. Since this ratio is not less than the UPL, the feasible range of the tariff-subsidy ratio corresponding to a feasible weight is the same as the one shown in (13):

$$0 < \tau^{*0} / \tau^{0} < UPL . \tag{13}$$

B. The interference case

In the case where export subsidies are prohibited but tariffs are allowed as trade policy measures, the domestic government is forced not to adopt an export subsidy as its policy measure. If it anticipates the foreign government will implement its trade policy measure in the same way as in the l-f case, the indifference curve of its objective function corresponding to the reservation level is still G^0G^0, but valid only for $\tau \le 1$. This is depicted as the portion $G^0G^0{}'$ in Fig.1. Given this indifference curve, the domestic lobby group maximizes its welfare non-cooperatively by controlling the political contributions offered to the governing party. The equilibrium is attained at a point on vertical line $\tau = 1$ where the lobbyist's indifference curve intersects $G^0G^0{}'$, implying that this equilibrium is a corner solution, or at a point to the left of the line where the lobbyist's indifference curve is tangent to $G^0G^0{}'$, implying that this equilibrium is an inner solution. Let π_U denote the value of a welfare weight for which the lobbyist's indifference curve is tangent to $G^0G^0{}'$ just on vertical line $\tau = 1$ at a given set of τ^{*0} and capital endowments. Then it is represented by

$$\pi_U = -\frac{x_1 /(\varepsilon m_1)}{1-\tau^{00}} . \tag{25}$$

Clearly, it is larger than π_L and regarded as a function of the local prices of good 1. Let π_U denote the lower limit of a relatively heavy welfare weight. Then a weight belonging to interval, $\pi_L < \pi < \pi_U$, is designated as a feasible and relatively light weight and a weight belonging to interval, $\pi_U \le \pi$, as a feasible and relatively heavy weight. Let τ_U^{*0} denote the equilibrium policy measure of the foreign country with π_U as its weight. Then it is represented by:

$$\tau_U^{*0} = \frac{\tau^{*00} x_1 /(\varepsilon m_1)}{x_1 /(\varepsilon m_1) + (1-\tau^{00}) x_1^* /(\varepsilon^* m_1^*)} . \tag{26}$$

It is greater than τ^{*00} but less than τ^{*00} / τ^{00}. From the argument developed above, we can derive the equilibrium policy measure of the home country in the i-r case as:

$$\tau^0 = 1 \qquad \text{for} \quad \pi_L < \pi < \pi_U ,$$

$$\tau^0(\tau^{*0},\ \pi) < 1 \qquad \text{for} \quad \pi_U \le \pi . \qquad (27)$$

The lobby group and the government of the foreign country anticipate the policy measure of the trading partner as the one shown in (27) and determine their own equilibrium policy measure and political contributions in the same way as in the l-f case. Therefore, it is the same as the one shown in (23).

The results derived so far in this section can be summarized as follows:

Proposition 1.

1. The political equilibrium trade policy measure of the country that imports the capital-using good is an import tariff in both the l-f and i-r cases, the level of which is represented by a product of τ^{*00}, the equilibrium policy measure in the case where there are no lobby activities, and $\left[1 - x_1^* /(\pi\varepsilon^* m_1^*)\right]^{-1}$, where π is a feasible welfare weight, ε^* the price elasticity of imports, and x_1^* / m_1^* the ratio of output to imports of the capital-using good.
2. If a welfare weight commonly adopted by all governments is feasible and relatively light, the political equilibrium trade policy measure of the country that exports the capital-using good is an export subsidy in the l-f case, the level of which is represented by a product of τ^{00}, the equilibrium policy measure in the case where there are no lobby activities, and $\left[1 + x_1 /(\pi\varepsilon m_1)\right]^{-1}$, where ε is the price elasticity of exports and x_1 / m_1 the ratio of output to exports of the capital-using good, while it is an export tariff of zero rates in the i-r case; if the welfare weight is feasible and relatively heavy, the equilibrium policy measure of this country is an export tariff in both cases, the level of which is represented in the same way as that of the export subsidy.

According to this proposition, the GATT rule of allowing import tariffs as trade policy measure is consistent with the equilibrium decision for trade policies by the member countries' governments. However, this is not the case for the GATT rule of prohibiting export subsidies for non-primary products. This is because if the capital-using good is a non-primary product, the export subsidies would constitute an equilibrium policy measure with a feasible and relatively light weight.

The feasible ranges of welfare weight and equilibrium tariff-subsidy ratios are respectively different in the i-r and l-f cases. If every government commonly adopts a relatively light weight at a given set of capital endowments, an exogenous shift from the l-f to the i-r case forces the domestic government to alter its equilibrium policy measure from an export subsidy to a zero tariff rate, according to Proposition 1. Then the tariff-subsidy ratio coincides with the foreign policy measure. This implies that the ratio becomes a decreasing function in a welfare weight under the *ceteris paribus* condition, having the UPL as its upper limit and τ_U^{*0} as its lower limit. If it were equal to the UPL, the weight would take its minimum value, which is denoted by π_L'. It is represented by:

$$\pi_L' = [(1-\tau^{*00}/UPL)(\delta(p^*)-\eta)]^{-1}. \tag{28}$$

Whether π_L' is larger than π_L is ambiguous. Thus, the following assumption is made,

Assumption 5: $\pi_L < \pi_L'$ for any equilibrium tariff-subsidy ratio within its feasible range (22).

Under this assumption, the feasible range of a welfare weight is represented in the i-r case by:

$$\pi_L' < \pi < \pi_U . \tag{29}$$

The feasible range of the equilibrium tariff-subsidy ratio corresponding to the feasible weight is represented by:

$$\tau_U^{*0} < \tau^{*0}/\tau^0 < UPL . \tag{30}$$

If a welfare weight is relatively heavy, a change from the l-f to the i-r case forces no governments to alter their policy measures according to Proposition 1. The equilibrium tariff-subsidy ratio is again an increasing function in a weight with τ_U^{*0} as its lower limit and the UPL as its upper limit under the *ceteris paribus* condition. Thus its feasible range is the same as the one shown in (30).

Ⅳ. The Nash Equilibrium Policy Measures

It was discussed in the previous section that as a political equilibrium policy measure for sector 1, the home country chooses an export subsidy or tariff in the l-f case and an export tariff of zero or positive rates in the i-r case while the foreign country chooses an import tariff in both cases on the condition that the welfare weight and the level of the trading partner's policy measure are given. This is in order to examine how the equilibrium policy measures are altered when these given variables are subject to change. This section considers two subjects concerning this question. One of them is the consideration of a tariff response function of each country - how the equilibrium level of a policy measure in one country responds to the alteration of the level of a policy measure by the trading partner under the condition that the welfare weight and the relative capital endowments are given. If the tariff response functions of the home and foreign countries intersect each other, then the Nash equilibrium policy measures are determined. Another subject examined in this section is how the equilibrium policy measures represented by the tariff-subsidy ratio are affected by a uniform alteration by governments in the welfare weight. The results imply distortion-mitigating effects of an export subsidy such that the domestic grant of this subsidy to the capital-using good reduces the distortion in the local price of this good between the two trading countries caused by the foreign imposition of a tariff on this good, and facilitates a recovery from a fall in the volume of trade in goods due to the distortion. The analysis of these subjects is carried out first in the l-f case and then in the i-r case.

A. **The laissez-faire case**

In this case, the equilibrium policy measures of the home and foreign countries are shown by (21) and (23), which can be described as implicit functions $f(\tau^{*0},\ \tau^{0};\ \pi) = 0$ and $f^{*}(\tau^{*0},\ \tau^{0};\ \pi) = 0$, respectively. Assume that there exists a solution to this equation system for a feasible welfare weight. Then this is the Nash equilibrium, where τ^{N} and τ^{*N} denote the policy measures of the home and foreign countries, respectively. According to

Proposition 1, the equilibrium policy measure of the foreign country is an import tariff on good 1 for any feasible weight while that of the home country is an export subsidy for it for a feasible and relatively light weight and an export tariff on it for a relatively heavy weight.

The responses of the Nash equilibrium policy measures to a change in the welfare weight can be examined using an equation system consisting of the tariff response functions differentiated at an initial Nash equilibrium. Let Φ and Φ_π denote the partial elasticity of the domestic tariff response function with respect to τ^{*N} and π, respectively and Φ^* and Φ_π^*, the counterparts of the foreign tariff response function, respectively. Then they can be represented in terms of these elasticities as:

$$\Phi\hat{\tau}^{*N} + (1-\Phi)\hat{\tau}^N = -\ \Phi_\pi\hat{\pi},$$
$$(1-\Phi^*)\hat{\tau}^{*N} + \Phi^*\hat{\tau}^N = -\ \Phi_\pi^*\hat{\pi}, \tag{31}$$

where $\Phi_\pi = (\tau^N - \tau^{00})/\tau^{00}$ and $\Phi_\pi^* = (\tau^{*N} - \tau^{*00})/\tau^{*00}$. It is obvious from Assumption 4 that $\Phi_\pi > \Phi_\pi^*$ for a feasible welfare weight. The properties of Φ and Φ^*, which are described by the variables, D_1, D_1^*, x_1, x_1^*, ε, and ε^*, will be clarified below (See Appendix for the explicit expressions of Φ and Φ^*).

The analysis developed in the previous section reveals that the policy measure of each country is a decreasing function in a welfare weight under the *ceteris paribus* condition. We can describe this in terms of its partial elasticity with respect to a weight using the first equation in (31) where $\hat{\tau}^{*N} = 0$ for the home country and the second equation where $\hat{\tau}^N = 0$ for the foreign country. They are represented, respectively, by

$$\left.\frac{\hat{\tau}^N}{\hat{\pi}}\right|_{\hat{\tau}^{*N}=0} = \frac{\Phi_\pi}{\Phi - 1}, \qquad \text{and} \qquad \left.\frac{\hat{\tau}^{*N}}{\hat{\pi}}\right|_{\hat{\tau}^{N}=0} = \frac{\Phi_\pi^*}{\Phi^* - 1}. \tag{32}$$

These expressions indicate, as one of the characteristics of the tariff response functions, that if Φ and Φ^* are both less than one, the equilibrium policy measure of each country is a monotonically decreasing function in a weight at a given level of the trading partner's policy measure because Φ_π and Φ_π^* are both positive. The analysis in the previous section also reveals that the equilibrium tariff-subsidy ratio is an increasing function in a weight under the *ceteris paribus* condition. Its elasticity is obtained by solving equation system (31) as:

$$\frac{\hat{\tau}^{*N}-\hat{\tau}^{N}}{\hat{\pi}}=\frac{\Phi_{\pi}-\Phi_{\pi}^{*}}{1-\Phi-\Phi^{*}}. \qquad (33)$$

A necessary and sufficient condition for this elasticity to be positive for any feasible weight is that the sum of Φ and Φ^* is less than one. Thus the following assumption is made:

Assumption 6: (a) $\Phi < 1$, (b) $\Phi^* < 1$, and (c) $\Phi + \Phi^* < 1$ at any Nash equilibrium within the feasible range.

The relation in (33) shows that as governments commonly put a heavier (lighter) weight on the welfare in their own country the Nash equilibrium tariff-subsidy ratio monotonically increases (decreases) under Assumption 6, implying that the local price of the capital-using good falls (rises) in the exporting country while it rises (falls) in the importing country. These local-price changes have discouraging (encouraging) effects on the exports and imports of this good to improve (deteriorate) the terms of trade of each country. Fig.2 illustrates the functional relationship between the equilibrium tariff-subsidy ratio, which is measured along the vertical axis, and the welfare weight, which is measured along the horizontal axis, in the l-f and i-r cases at a fixed set of relative capital endowments. An upward-sloping curve T^P shows the relationship in the l-f case. It starts at a point in the neighborhood of point L, which has the coordinates $(\pi_L,\ 0)$, passes through point M, with coordinates $(\pi_1,\ 1)$, where π_1 denotes the value of welfare weight at which $\tau^{*N}/\tau^N = 1$ or $\pi_1 = -[x_1\tau^{*00}/(\varepsilon m_1) + x_1^*\tau^{00}/(\varepsilon^* m_1^*)]/(\tau^{*00} - \tau^{00})$, and point U, with coordinates $(\pi_U,\ \tau_U^{*N})$, where τ_U^{*N} is the Nash equilibrium policy measure of the foreign country with π_U as its weight. Curve T^P ends at a point in the neighborhood of point E, which has the coordinates $(\pi_H,\ UPL)$, where π_H denotes a value of the welfare weight at which $\tau^{*N}/\tau^N = UPL$ or $\pi_H =$ $[(\tau^{*00}/\tau^{00})/(\delta(\gamma p)-\eta) - UPL/(\delta(p^*)-\eta)]/(\tau^{*00}/\tau^{00} - UPL)$. Although it is ambiguous whether π_1 is greater than $\pi_L{}'$, Fig.2 is depicted under the assumption that this is the case.

(Fig.2 here)

B. The interference case

If, as summarized in Proposition 1, a welfare weight adopted commonly by the home and foreign governments is feasible and relatively light, $\pi_L{}' < \pi < \pi_U$, the tariff response functions of the two countries are respectively shown as implicit functions $\tau^0(\tau^{*0}; \pi) = 1$ and $f^*(\tau^{*0};\ \pi) = 0$ in the i-r case. They have an intersection because the foreign equilibrium policy measure takes any value greater than τ^{*00} in response to the equilibrium measure of the trading partner, $\tau^0 = 1$, for a given feasible weight. This is the Nash equilibrium in this case. The response of the foreign policy measure to a change in the welfare weight is represented by the second equation in (31) where $\hat{\tau}^N = 0$,

$$(1 - \Phi^*)\hat{\tau}^{*N} = -\ \Phi^*_\pi \hat{\pi}\ .$$

Therefore, the elasticity of the tariff-subsidy ratio with respect to the weight is represented by

$$\frac{\hat{\tau}^{*N} - \hat{\tau}^N}{\hat{\pi}} = -\frac{\Phi^*_\pi}{1 - \Phi^*}\ , \tag{34}$$

which is negative under Assumption 5. This indicates that as the governments commonly put a heavier (lighter) weight on welfare in their own country, the Nash equilibrium tariff-subsidy ratio monotonically decreases (increases), implying that the local price of good 1 goes up (down) in the home country and goes down (up) in the foreign country. These changes in the local price result in an expansion (shrinkage) of the exports and imports of this good. In Fig.2, a downward-sloping curve T^G represents the functional relationship between the equilibrium tariff-subsidy ratio and the welfare weight in the i-r case. It starts at a point in the neighborhood of point E', which has the coordinates $(\pi_L{}',\ UPL)$ and coincides with T^P at point U. If, on the other hand, the welfare weight adopted by the governments are feasible and relatively heavy, $\pi > \pi_U$, the tariff response functions of the two countries are represented by (31). Therefore, the relationship between the equilibrium tariff-subsidy ratio and the welfare weight is depicted by the portion of curve T^P corresponding to relatively heavy welfare weights. Thus τ_U^{*N} is the lower limit of the equilibrium tariff-subsidy ratio in the i-r case.

We can compare the Nash equilibrium tariff-subsidy ratios between the l-f and i-r cases in Fig.2. Let $\tau^{*N}/\tau^{N})^{P}$ and $\tau^{*N}/\tau^{N})^{G}$ denote the equilibrium tariff-subsidy ratios in the l-f and i-r cases, respectively. For a feasible and relatively light welfare-weight adopted commonly by governments, the ratio in the l-f case lies on curve T^{P} while the ratio in the i-r case lies on curve T^{G}. It is obvious from the figure that

$$\tau^{*N}/\tau^{N})^{P} < \tau^{*N}/\tau^{N})^{G}. \tag{35}$$

This relation results in $m_1^*)^{P} > m_1^*)^{G}$, where $m_1^*)^{P}$ and $m_1^*)^{G}$ denote the imports of the capital-using good in the l-f and i-r cases, respectively. These results indicate the distortion-mitigating effects of the export subsidy such that the inequality between p^* and p caused by the foreign imposition of a tariff on this good and a consequent decrease in the volume of trade in goods are mitigated by the domestic export subsidy for it in the l-f case. If a welfare weight adopted by governments is feasible and relatively heavy, a shift from the l-f to the i-r case results in $\tau^{*N}/\tau^{N})^{P} = \tau^{*N}/\tau^{N})^{G}$, implying no changes in the volume of trade in goods.

The results obtained so far can be summarized in the following proposition.

Proposition 2. If a welfare weight adopted commonly by all governments is feasible and so light that the exporter's political equilibrium trade policy measure is an export subsidy for the capital-using good in the l-f case, then the disparity in its local price between the importer and exporter is smaller, and consequently the volume of trade in goods is larger in the l-f case than in the i-r case with the same welfare weight..

If good 1 is a non-primary product according to GATT rules, the l-f and i-r cases mean the p-G and G/W regimes, respectively, for the member countries of the GATT/WTO, as pointed out in Section I. Thus, this proposition implies that under the assumption made above, there is a transition from the p-G to the G/W regime in the world economy comprising the two member countries, and this leads to an enlargement of the disparity in the local price of the capital-using good and a reduction in the volume of trade in goods between them. This implication serves to explain the paradoxical results obtained by Rose (2004) that the GATT/WTO does not systematically contribute to the expansion of trade in its member countries.

V. The Welfare Effects of a Shift from the Laissez-faire to the Interference Case

We demonstrated in the previous section that a shift in the world economy from the l-f to the i-r case increases the disparity in the Nash equilibrium tariff-subsidy ratio between the foreign and home countries with a common light welfare weight such that the political equilibrium trade policy measure of the home country is an export subsidy for the capital-using good. A rise in the tariff-subsidy ratio accompanies a fall in the domestic local price and a rise in the foreign local price of this good, while its effect on the world price is ambiguous. The purpose of this section is to explore the welfare effects of the change in institutional trade conditions. However, its effects on domestic and foreign welfare are not clear because the fall in p (a rise in p^*) increases (decreases) the consumer's surplus but decreases (increases) capital reward in the home (foreign) country and because the effects of these price changes on the foreign tariff revenues are ambiguous, although the domestic subsidy payments are reduced to zero by the shift from the l-f to the i-r case. Thus we focus our attention on the effects on the world welfare defined below.

Since the per capita welfare of the two countries are countable and measurable in terms of the numeraire good as shown in (10), the per capita world welfare can be defined as their weighted average $\rho W + (1-\rho)W^*$, where the weight is each country's share of labor supply in the world total. Noting that the per capita net receipts from the tariff revenues and subsidy payments $\rho B + (1-\rho)B^*$, one of its components, can be rewritten as $\rho p m_1 +$ $(1-\rho)p^* m_1^*$ both in the l-f and i-r cases, the world welfare can be represented as a function of the Nash equilibrium tariff-subsidy ratio at a given set of the domestic-labor-efficiency ratio and the relative capital endowments:

$$y = 1 + \rho p\left[\frac{\eta}{1+\eta}D_1 - (1-\alpha(\gamma p))x_1\right] + (1-\rho)p^*\left[\frac{\eta}{1+\eta}D_1^* - (1-\alpha(p^*))x_1^*\right]. \tag{36}$$

Its variation due to a change in the tariff-subsidy ratio can be derived using the results obtained in the previous sections as

$$dy = Q_{YT}(\hat{\tau}^{*N} - \hat{\tau}^{N}), \tag{37}$$

where Q_{YT} denotes the variation of world welfare due to a relative change in the tariff-subsidy ratio and is represented by

$$Q_{YT} = -\frac{(1-\rho)pm_1^*}{\tau^{*00} - \tau^{00}}\left(\frac{\tau^{*N}}{\tau^N} - 1\right). \tag{38}$$

It is obvious from (38) that $Q_{YT} \geq (<) 0$ provided $\tau^{*N}/\tau^N \leq (>) 1$. This shows that world welfare is maximized when the local prices of good 1 are equalized between the two countries, and is reduced as the difference between them expands. The maximum level of world welfare is the same as the one realized under free trade[7].

The welfare effects that we are exploring can be illustrated by drawing a graph of world welfare levels associated with the welfare weight at a fixed set of γ, k, and k^*. Let $y^P(\pi)$ denote the level in the l-f case. Its relationship with the weight is derived by considering the monotonically increasing relation of the equilibrium tariff-subsidy ratio to the weight shown in (33):

$$\frac{dy^P(\pi)}{\hat{\pi}} = \frac{Q_{YT}(\Phi_\pi - \Phi_\pi^*)}{1 - \Phi - \Phi^*}. \tag{39}$$

The graph can be depicted in the (y, π) coordinate-plane. For a feasible welfare weight, Φ_π is larger than Φ_π^* under Assumption 4, and $\Phi + \Phi^*$ is less than one under Assumption 6. Thus, curve $y^P(\pi)$ is upward sloping for a weight below π_1, reaches its maximum point at π_1, and is downward sloping for a weight greater than this. As the weight is raised to its upper bound, π_H, the curve approaches a welfare level at the UPL, where international trade in goods completely vanishes. Let $\underline{y}$ denote this no-trade welfare level. Then, it is represented by

$$\underline{y} \equiv y^P(\pi_H) = 1 + e^{-\eta}\left[\rho\big(\alpha(\gamma p) - 1/(1+\eta)\big)p^{1+\eta} + (1-\rho)\big(\alpha(p^*) - 1/(1+\eta)\big)p^{*1+\eta}\right], \tag{40}$$

where $p = 1/\mathrm{K}(\gamma, k)$ and $p^* = 1/\mathrm{K}(k^*)$, as shown in Section Ⅱ. This welfare level is lower than $y^P(\pi)$ for any feasible weight in this case because of the loss in trade gains. Let point S have the coordinates (π_L, $y^P(\pi_L)$), point B (π_1, $y^P(\pi_1)$), point J (π_U, $y^P(\pi_U)$), and point Z (π_H, $y^P(\pi_H)$), as shown in Fig.3. Curve $y^P(\pi)$ is depicted as a curve starting at a point in the neighborhood of point S, reaching its maximum point B at π_1, passing through point J at π_U and descending to a point in the neighborhood of point Z.

(Fig.3 here)

In the i-r case, on the other hand, the equilibrium tariff-subsidy ratio is a monotonically decreasing function in the welfare weight as shown by (34). Let $y^G(\pi)$ denote the welfare level at a given set of γ, k, and k^* in this case. Then its relation to π is represented by

$$\frac{dy^G(\pi)}{\hat{\pi}} = -\frac{Q_{YT}\Phi^*_\pi}{1-\Phi^*}. \tag{41}$$

Curve $y^G(\pi)$ is upward sloping over the whole range of the relevant values of the weight $\pi_L{}' < \pi \leq \pi_U$ because $\Phi^*_\pi > 0$, $\Phi^* < 1$ and $Q_{YT} < 0$. Let point Z' in Fig.3 have the coordinates ($\pi_L{}'$, $y^G(\pi_L{}')$), where trade in goods completely vanishes, so that $y^G(\pi_L{}') = \underline{y} = y^P(\pi_H)$. Curve $y^G(\pi)$ is then depicted as a curve starting from a point in the neighborhood of point Z', rising monotonically as the weight is increased, and joining $y^P(\pi)$ at point J. The height of curve $y^G(\pi)$ is lower than that of curve $y^P(\pi)$ at a point in the neighborhood of point Z' because $y^G(\pi_L{}')$ is equal to $y^P(\pi_H)$, which is lower than $y^P(\pi)$ for any weight feasible in the i-r case. Therefore, curve $y^G(\pi)$ lies below curve $y^P(\pi)$ as shown in the figure.

If a welfare weight adopted commonly by all governments is feasible and so light that the domestic equilibrium policy measure is an export subsidy for the capital-using good in the l-f case, the world economy lies on segment SBJ of curve $y^P(\pi)$, except for points S and J, in this case, and on curve $y^G(\pi)$ in the i-r case. Therefore, its shift from the l-f to the i-r case at a relevant weight drops it from a point on curve $y^P(\pi)$ straight down to a point on curve $y^G(\pi)$, implying a deterioration of world welfare. The reason for this welfare loss is that the shift expands the disparity in the local prices of good 1 between the two trading countries, as stated in Proposition 2. If the welfare weight is so heavy that the domestic policy measure is an export tariff in the l-f case, the world economy lies at a point on the segment of curve $y^P(\pi)$ to the right of point J in both cases. Thus a shift of the world economy from the l-f to the i-r case does not affect the level of world welfare.

The results derived so far in this section can be summed up as follows:

Proposition 3. If a welfare weight adopted commonly by all governments is feasible and so light that the exporter's political equilibrium trade-policy measure is an export subsidy for the capital-using good in the l-f case, the level of world welfare in this case is higher than the one in the i-r case at the same welfare weight.

If the capital-using good is a non-primary product according to the GATT rules, the l-f and i-r cases mean the p-G and G/W regimes, respectively, for the member countries of the GATT/WTO. Thus the proposition suggests that their transition from the p-G to the G/W regime decreases the level of world welfare unless the weight adopted by them is so heavy that the exporter's policy measure is an export tariff even under the p-G regime. This implies that the GATT rules of allowing tariffs and prohibiting export subsidies to non-primary products as trade policy measures is inconsistent with its objective of raising the living standard of all member countries.

Ⅵ. Conclusions

In order to explore more comprehensively the welfare-improving effects of an export subsidy, this paper constructed a general equilibrium model of two countries, two goods, and two factors with capital specific to a non-numeraire good as one of the factors, and Harrod-neutrally different production technologies. It then combined this specific-factor model with the political contributions approach to protection, which argues that trade policy measures of a country are determined in a political equilibrium between lobby groups that demand import protection or export encouragement from the government, and the government that needs votes from the citizens and political contributions for campaign funds from the lobby groups in elections. Lastly, it compared the laissez-faire case of allowing tariffs and export subsidies as trade policy measures with the interference case of prohibiting export subsidies and allowing tariffs with respect to trade policy measures, the volume of trade in goods, and the level of world welfare defined as the weighted average of the two countries' welfare levels.

In this framework, the following conclusions can be derived: (1) If the government in each country puts a relatively light weight on the national welfare compared with political contributions by a lobby group, the equilibrium policy measure of a country exporting the capital-using good is an export subsidy for it while the policy measure of a country importing the good is an import tariff in the laissez-faire case. This implies that the exporter's equilibrium policy measure is inevitably changed to a zero export tariff while the importer's remains an import tariff in the interference case; (2) If the equilibrium policy measure of the exporting country is an export subsidy in the laissez-faire case, an exogenous shift of the two countries from this case to the interference case expands the disparity in the local price of the capital-using good due to its fall in the exporting country and its simultaneous rise in the importing country. As a result, the shift decreases the volume of international trade in goods and worsens world welfare.

If the two countries are members of the GATT/WTO, and if the subsidized good is a non-primary product, then we may regard the laissez-faire case as a regime prevailing in the era before the GATT was established and the interference case as a regime prevailing under the GATT/WTO. Thus, our conclusions imply that a transition of the member countries from the pre-GATT to the GATT/WTO regime reduces the volume of trade in goods and the level of world welfare by expanding the disparity in the local price of the capital-using good. This implication contradicts the conclusions derived by Bagwell and Staiger (1999) that the GATT/WTO is efficient by virtue of its principles of reciprocity and nondiscrimination because they serve to make the indifference curves of the member-countries' governments tangent to each other. There seem to be two reasons for this contradiction. The first is the GATT's departure from the reciprocity principle by prohibiting export subsidies in spite of the allowance of import and export tariffs. In order for it to be faithful to the principle, it should prohibit tariffs as well as export subsidies. Then the rates of import tariffs and export subsidies are simultaneously reduced to zero under the GATT/WTO regime, raising the level of world welfare to the maximum level and making this regime superior to the pre-GATT regime unless positive rates of import tariffs and export subsidies happen to be the same under this regime. The second reason is the fact that the GATT's nondiscrimination principle was ignored in this paper because it is automatically satisfied in the two-country model. If it is extended to include three or more countries and, moreover, discriminatory trade policy measures are implemented in the laissez-faire case but not in the interference case, then the contradiction might be resolved.

Footnotes

[1] The survey of the political economy models of trade policy can be seen in Rodrik (1995).

[2] The development in the study of the strategic trade policy pioneered by Brander-Spencer (1985) can be seen in Brander (1995).

[3] They also show that the optimal trade policy for the domestic and foreign governments to maximize cooperatively their combined welfare is an export subsidy in the same setting as shown in the text.

[4] According to the preamble of the GATT/WTO, its objectives are raising the standards of living, ensuring full employment and a large and steadily growing volume of real income and effective demand, developing the full use of the resources of the world and expanding the production and exchange of goods.

[5] The GATT/WTO allows import and export tariffs as trade policy measures in its Articles II and XI and prohibits unconditionally export subsidies to non-primary products in its Article XIV. But it grants the exceptions to primary products provided that the subsidy received does not displace the exports of another member and thereby provide the recipient with more than an equitable share of world export trade in the product. See Jackson (1997) for the evolution of the rules on subsidies in the GATT/WTO and Bagwell and Staiger (2001) for the agricultural trade disputes in the GATT/WTO.

[6] The utility represented by function (1) is countable and measurable. The utility functions with these properties are used both in the strategic-trade-policy model and the political contributions approach to protection.

[7] Grossman and Helpmen (1995) points out the possibility that if the rate of import tariff levied on a good by a country is equal to the rate of export subsidy granted to the same good by another country, then the world welfare together with the local prices of the good and the volume of its trade reaches the same levels as in free trade. However, they argue neither the distortion-mitigating effect of the export subsidy nor its implication to the GATT/WTO rules of allowing import tariffs but prohibiting export subsidies to non-primary products.

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Appendix

From (21), the relative change in τ^N induced by a change in π can be derived at a fixed set of capital endowments:

$$\hat{\tau}^N = \hat{\tau}^{00} - \Phi_\pi \left(\frac{\eta D_1}{\varepsilon m_1} (\hat{D}_1 - \hat{x}_1) - \frac{\delta(\gamma p) x_1 \sigma_{\delta p}}{\varepsilon m_1} \hat{p} + \hat{\pi} \right) \tag{A-1}$$

Substituting into (A-1) (16) in the text and the following expressions,

$$\hat{\tau}^{00} = \frac{(1-\tau^{00})}{\tau^{00}} [E_p^* + \frac{\varepsilon \delta(p^*) x_1^* \sigma_{\delta p}^*}{\varepsilon^* (\varepsilon + \varepsilon^*) m_1^*}](\hat{\tau}^{*N} - \hat{\tau}^N) \ ,$$

where E_p^* denotes the price elasticity of ε^*, $E_p^* = \frac{\varepsilon(\delta(p^*) - \eta)^2 D_1^* x_1^*}{\varepsilon^*(\varepsilon + \varepsilon^*)(m_1^*)^2} > 0$, and

$$\hat{D}_1 - \hat{x}_1 = \frac{\varepsilon^* (\delta(\gamma p) - \eta)}{\varepsilon + \varepsilon^*} (\hat{\tau}^{*N} - \hat{\tau}^N) ,$$

we can get the first equation of (31), where

$$\Phi = - \left(\frac{(1-\tau^{00}) E_p^*}{\tau^{00}} - \frac{\eta \varepsilon^* (\delta(\gamma p) - \eta) D_1 \Phi_\pi}{\varepsilon(\varepsilon + \varepsilon^*) m_1} + \frac{(1-\tau^{00}) \varepsilon \delta(p^*) x_1^* \sigma_{\delta p}^*}{\tau^{00} \varepsilon^* (\varepsilon + \varepsilon^*) m_1^*} - \frac{\varepsilon^* \delta(\gamma p) x_1 \sigma_{\delta p} \Phi_\pi}{\varepsilon(\varepsilon + \varepsilon^*) m_1} \right).$$

Similarly, the second equation of (31) can be derived from (23) using the relationships,

$$\hat{\tau}^{*00} = - \frac{(\tau^{*00} - 1)}{\tau^{*00}} [E_P + \frac{\varepsilon^* \delta(\gamma p) x_1 \sigma_{\delta p}}{\varepsilon(\varepsilon + \varepsilon^*) m_1}](\hat{\tau}^{*N} - \hat{\tau}^N) \ ,$$

where E_P denotes the price elasticity of ε, $E_p = \frac{\varepsilon^* (\delta(\gamma p) - \eta)^2 D_1 x_1}{\varepsilon(\varepsilon + \varepsilon^*) m_1{}^2} > 0$, and

$$\hat{D}_1^* - \hat{x}_1^* = - \frac{\varepsilon(\delta(p^*) - \eta)}{\varepsilon + \varepsilon^*} (\hat{\tau}^{*N} - \hat{\tau}^N) .$$

Therefore,

$$\Phi^* = - \left(\frac{(\tau^{*00} - 1) E_p}{\tau^{*00}} + \frac{\eta \varepsilon (\delta(p^*) - \eta) D_1^* \Phi_\pi^*}{\varepsilon^* (\varepsilon + \varepsilon^*) m_1^*} + \frac{(\tau^{*00} - 1) \varepsilon^* \delta(\gamma p) x_1 \sigma_{\delta p}}{\tau^{*00} \varepsilon(\varepsilon + \varepsilon^*) m_1} + \frac{\varepsilon \delta(p^*) x_1^* \sigma_{\delta p}^* \Phi_\pi^*}{\varepsilon^* (\varepsilon + \varepsilon^*) m_1^*} \right).$$