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Endogenous Trade Policies,WTO Rules and International Capital Movement

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Abstract

This paper views the modern world economy to be constructed with democratic countries that implement trade policies as an income distribution policy, World Trade Organization that intends to improve world welfare by prohibiting export subsidies but allowing import and export tariffs, and international capital movement. Based on this view, it explores the effects of these WTO rules on the volume of international trade in goods, the direction and volume of international capital movement and world welfare in a two-country, two-good, two-factor model with capital specific to the production of one good and internationally different production technologies. It shows that if the export subsidies and import tariffs prevail as the Nash equilibrium trade-policy measures in the era before the WTO is established, the enforcement of those WTO rules reduces the volume of trade in goods, expands international capital movement the direction of which is the same as international trade in the capital-intensive good but shrinks international capital movement the direction of which is opposite to it, and the expansion in international capital movement cannot necessarily compensate the loss of world welfare caused by the reduction in international trade in goods and the failure in achieving the Pareto optimum in the domestic political equilibrium as a result of the prohibition of export subsidies.

Key Words: specific factor, different technologies, export subsidies, Nash equilibrium

JEL Classification: F13, F21

I. Introduction[1]

This paper views the modern world economy to be constructed with democratic countries that implement trade policies as an income distribution policy, the General Agreement on Tariffs and Trade (GATT) and its successor, World Trade Organization (WTO), that intends to improve world welfare by reducing substantially tariffs and other barriers to trade[2] and international capital movement. Based on this view, it explores the relations among the trade policies by the countries, the GATT/WTO, the volume of trade in goods, and the direction and volume of international capital movement.

In the country with representative democracy, according to the political contributions approach to protection developed by Grossman-Helpman (1994, 1995)[3], the policy measure is determined in the political equilibrium between a lobby group which represents the owners of a factor specific to an industry and the government which is concerned about the next election. Thus the equilibrium policy measure is an import tariff in a country where the industry is import-competitive and an export subsidy or tariff in a country where it is exporting. Taking such a policy decision of the member countries as a background, the GATT/WTO has made rules of allowing import and export tariffs and prohibiting export subsidies as policy measures[4].

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[2] 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.

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

[4] In reality, the GATT/WTO allows import and export tariffs as trade-policy measures in its

International capital movement taken up here is not the foreign direct investment in the form of the establishment of overseas factories as considered by Helpman (1984) and Grossman-Helpman (1996) but the foreign direct investment in the form of inter-country movement of the stock of physical capital as considered by Mundell (1957). Capital is assumed to move freely from a country with low rental to a country with high rental because its level directly depends only on the domestic price of the capital-intensive good in the framework of this paper, and hence the lobby group is not concerned with controlling the inflow and outflow of capital.

This paper tries to show that if the export subsidies and import tariffs prevail as the Nash equilibrium trade-policy measures in the era before the GATT is established, then the enforcement of those GATT/WTO rules has the following effects on the world economy: (1) it reduces the volume of international trade; (2) it expands international capital movement the direction of which is the same as trade in the capital-intensive good but shrinks international capital movement the direction of which is opposite to it; and (3) the expansion in international capital movement does not necessarily compensate the loss of world welfare due to the reduction in international trade and the inefficiency caused by the enforcement of the rules.

The configuration of this paper is as what follows. The two-country, two-good and two-factor model with a specific factor (capital) is presented in section II. Section III shows in the framework of the political contributions approach to protection that the equilibrium policy measure is an import tariff in a country that imports an capital-intensive good (foreign country)

Articles II and XI and prohibits export subsidies in The Uruguay Round Agreement on Subsidies and Countervailing Measures Article III. See Jackson (1997) for the evolution of the rules on subsidies in the GATT/WTO.

and an export subsidy/tariff in a country that exports it (home country) under an trading regime with free international capital movement and no GATT rules (pre-GATT regime) and that it remains an import tariff in the foreign country while it is an export tariff of a positive rate or regulated to that of zero rates in the home country under another regime with the GATT/WTO rules and free international capital movement (GATT/WTO regime). Section IV discusses the response of the country's equilibrium policy measure to a change in the level of the trading partner's equilibrium policy measure. Section V is devoted to presenting the mechanism of international capital movement. Section VI shows that the Nash equilibrium policy measure is an import tariff for the foreign country and an export subsidy or tariff for the home country, depending on the relative evaluation of the governments for the national welfare and the political contributions. This section then explores the effects of the transition from the pre-GATT to the GATT/WTO regime on the volume of international trade in goods and the direction and volume of international capital movement. Section VII defines world welfare to explore the effects on it of the transition in the trading regime by utilizing the results of the previous section. Conclusions are summed up in section VIII.

II. The Specific-Factor Model

There are two countries, home and foreign countries, in the world and two goods, good 1 and good 2, are produced in each country. Good 2 is used as a numeraire good. An individual obtains satisfaction by consuming goods 1 and 2, and the level of satisfaction, u, is assumed to be measured with a utility function of an additively separable type. Let D_i denote the individual's consumption of good i $(i = 1, 2)$ and let e be a positive number less than one, then the utility function is represented by

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

Let p and I denote the price of good 1 and the individual's income, respectively, both measured in terms of good 2 and by solving the constrained utility-maximization problem his/her demand function for good 1 can be derived:

$$D_1 = (p/e)^{\eta}, \tag{2-a}$$

where η denotes the price elasticity of the demand for good 1 and equals $-1/(1-e)$, a negative number less than -1. The demand function of good 2 is derived at the same time. Substituting these demand functions into the utility function (1) yields 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, I can obtain the foreign individual's demand function of good 1:

$$D_1^* = (p^*/e)^{\eta}. \tag{2-b}$$

It is assumed that good 1 is produced with labor and capital which is a specific factor to good 1 and that good 2 is produced with labor alone in each country. Thus labor is a general factor used for the production of the two goods, and good 1 may be designated as a capital-intensive good. The production function of each good is assumed to be subject to constant returns to scale. Let X_i, L_i and K denote the output of good i, the input of labor required to produce X_i $(i = 1, 2)$ and the input of capital required to produce X_1, respectively, and α a positive number less than one. Assume that the production function of sector 1 is of the Cobb-Douglas type and different between the two countries in the Harrod neutral sense. Let γ denote the efficiency coefficient of home country labor relative to foreign country labor, which is hereafter designated as the labor-efficiency ratio, and assume

this ratio to be a positive constant. Assume also that the labor productivity in sector 2 is just equal to one in each country, then the production functions of the two countries are represented for sectors 1 and 2, respectively, by

$$X_1 = K^{\alpha}(\gamma L_1)^{1-\alpha} \quad \text{and} \quad X_1^* = K^{*\alpha} L_1^{*1-\alpha}, \quad \gamma > 0, \quad 0 < \alpha < 1. \tag{3}$$

$$X_2 = L_2 \quad \text{and} \quad X_2^* = L_2^*. \tag{4}$$

Product as well as factor markets are assumed to be perfectly competitive in each country. Let w and r_1 denote the wage rate in terms of good 2 and rental in terms of good 1, respectively, then the profit maximization condition for competitive firms with positive outputs in home country sectors 1 and 2 are shown as a representative of the conditions of the two countries by

$$w = (1-\alpha) p \gamma^{1-\alpha} (K/L_1)^{\alpha} = 1 \quad \text{and} \quad r_1 = \alpha (K/\gamma L_1)^{\alpha-1}. \tag{5}$$

Let L and $\overline{K}$ denote the fixed volumes of labor supply and capital stock in the home country, respectively, and assume that labor and capital are immobile between countries. Then the home country full employment conditions for labor and capital are represented as a representative of the conditions in the two countries, respectively, by

$$L_1 + L_2 = L, \quad \text{and} \quad K = \overline{K}. \tag{6}$$

In order to put all variables in the per capita basis, I assume that the number of individuals is equal to the labor endowment in each country. This assumption implies that the fraction of the owners of specific capital in the total population is negligibly small. Denote per capita output of sector 1, X_1/L, by x_1, per capita input of capital in that sector, K/L, by k, per capita effective capital by $\tilde{k}$, where $\tilde{k} = \gamma^{\delta} k$, and the (partial) price elasticity of supply of good 1 by δ, which is equal to $(1-\alpha)/\alpha$. Then per capita outputs of good 1 can be represented by virtue of (3) and (5) in the home and foreign countries, respectively

$$x_1=[(1-\alpha)p]^{\delta}\tilde{k} \quad \text{and} \quad x_1^{*}=[(1-\alpha)p^{*}]^{\delta}k^{*}. \tag{7}$$

The ranges of the price of good 1 that make the outputs of both goods positive are represented for the home and foreign countries, respectively, by

$$0<p<[(1-\alpha)\tilde{k}^{\alpha}]^{-1} \quad \text{and} \quad 0<p^{*}<[(1-\alpha)k^{*\alpha}]^{-1}. \tag{8}$$

At the same time rental for capital in terms of good 1 can be represented in the home and foreign country, respectively, by

$$r_1=\alpha x_1/k \quad \text{and} \quad r_1^{*}=\alpha x_1^{*}/k^{*}. \tag{9}$$

These equations show that rental depends only on the domestic price of good 1 and increases as it rises in each country.

Suppose that the home country exports the capital-intensive good, and that its available measure of income distribution policy is an ad valorem export subsidy to this export good. Let t, B and q denote the subsidy rate ($t>0$) or the tariff rate ($t<0$), per capita subsidy payments or tariff revenues and the world price of this good in terms of the numeraire good, respectively, and let $\tau=1+t$. Then the domestic price is represented by $p=\tau q$, and the payments or revenues by $B=(\tau-1)q(D_1-x_1)$. I assume that the home government collects the payments for subsidy from the citizens using a head tax or that it distributes the tariff revenues to them using a head subsidy. Then the per capita welfare of the home country, W, is represented by

$$W=1+B+S+pr_1k, \tag{10-a}$$

where the first term in the RHS of (10-a) represents the wage rate, and the last term represents the per capita rent of home country capital. Suppose also that the foreign country imports the capital-intensive good, and that its available measure of income distribution policy is an ad valorem import tariff on this import good. Let t^{*} and B^{*} denote the tariff rate and per

capita tariff revenues, respectively, and let $\tau^* = 1 + t^*$. Then the foreign domestic price of this good is represented by $p^* = \tau^* q$ and the tariff revenues by $B^* = (\tau^* - 1)q(D_1^* - x_1^*)$ where $D_1^* \equiv D_1(p^*)$ and $x_1^* = x_1(p^*, k^*)$. Assume that the revenues are redistributed to the foreign citizens on an equal, per capita basis by their government, then the per capita welfare of the foreign country, W^*, is represented by

$$W^* = 1 + B^* + S^* + p^* r_1^* k^*. \tag{10-b}$$

Let m_1 and m_1^* denote per capita imports (negative exports) of good 1 by the home and foreign countries, respectively. Then the home country exports of good 1 is represented by

$$m_1(p, \tilde{k}) = D_1(p) - x_1(p, \tilde{k}) \le 0. \tag{11-a}$$

This equation and (6) determine the ranges of $\tilde{k}$ and p that are consistent with the conditions for the diversified production and for good 1 not to be imported by the home country. They are represented respectively by

$$\tilde{k} < [e(1-\alpha)]^{\frac{\eta(1+\alpha)}{1+\eta}} \quad \text{and} \quad (\mu\tilde{k})^{\frac{1}{\eta-\delta}} \le p \le [(1-\alpha)\tilde{k}^{\alpha}]^{-1}, \tag{12-a}$$

where $\mu = e^{\eta}(1-\alpha)^{\delta} > 0$.[1] The foreign per capita imports of good 1 is represented by

$$m_1^*(p^*, k^*) = D_1^*(p^*) - x_1^*(p^*, k^*) \ge 0. \tag{11-b}$$

The ranges of k^* and p^* that are consistent with the requirements for the diversified production and for good 1 not to be exported by the foreign country are determined in the same way as in the home country:

$$k^* < \left[e(1-\alpha)\right]^{-\frac{\eta(1+\alpha)}{(1+\eta)}} \quad \text{and} \quad 0 < p^* \le (\mu k^*)^{\frac{1}{\eta-\delta}}. \tag{12-b}$$

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[1] The LHS equality of the second expression in (12-a) holds if and only if $m_1 = 0$, and the RHS equality holds if and only if $L_1 = L$.

This range of p^* is narrower than the range for the diversified production shown in (8) because the two goods must be produced even when $m_1^* = 0$. The range of k^* is the same as that of $\tilde{k}$. The conditions which prescribe the feasible ranges of p, p^*, $\tilde{k}$ and k^* serve to determine the relative abundance of the effective capital between the two countries and the feasible range of τ^* / τ, the tariff-subsidy ratio, which is consistent with the pattern of trade and the diversified production in the two countries. It is obvious from the conditions on the domestic prices of good 1 in (12) that in order to avoid an unnecessary restriction on the tariff-subsidy ratio that it must be less than one, it is necessary and sufficient for the feasible ranges of the domestic prices to have an overlapping portion. This is equivalent to assume:

Assumption 1. The home country has a relatively abundant endowment of the effective capital. That is, $\tilde{k} \geq k^*$.

Under these conditions the feasible range of the tariff-subsidy ratio is determined by (12) as

$$0 < \tau^* / \tau \leq (\tilde{k} / k^*)^{\frac{1}{\delta - \eta}}, \tag{13}$$

where the equality holds if and only if $m_1 = m_1^* = 0$. The proportional change in the exports of good 1 is represented by

$$\hat{m}_1 = \varepsilon \hat{p} - (x_1 / m_1)(\hat{k} + \delta \hat{\gamma}), \tag{14-a}$$

where a variable with a hat at its head denotes its proportional change and ε denotes the price elasticity of the exports which is represented by $\varepsilon = (D_1 \eta - x_1 \delta) / m_1 > \delta$. The proportional change in the imports of good 1 is represented by

$$\hat{m}_1^* = -\varepsilon^* \hat{p}^* - (x_1^* / m_1^*)\hat{k}^*, \tag{14-b}$$

where ε^* denotes the price elasticity of the imports and is represented by $\varepsilon^* = (x_1^* \delta -$

$D_1^*\eta)/m_1^* > -\eta$.

The equilibrium domestic prices of good 1 (and hence the world price) are determined in terms of the exogenous variables, τ, τ^*, $\tilde{k}$ and k^* by the world market-clearing condition:

$$\rho m_1(p, \tilde{k}) + (1-\rho)m_1^*(p^*, k^*) = 0, \tag{15}$$

where ρ denotes a fixed share of the home country labor supply in the total world supply, $L^w = L + L^*$. They are represented in the form of a proportional change by

$$\hat{p} = -\frac{\varepsilon^*}{\varepsilon+\varepsilon^*}(\hat{\tau}^* - \hat{\tau}) + \frac{1}{\varepsilon+\varepsilon^*}\left[\frac{x}{m}(\hat{k} + \delta\hat{y}) - \frac{x_1^*}{m_1^*}\hat{k}^*\right],$$

$$\hat{p}^* = \frac{\varepsilon}{\varepsilon+\varepsilon^*}(\hat{\tau}^* - \hat{\tau}) + \frac{1}{\varepsilon+\varepsilon^*}\left[\frac{x}{m}(\hat{k} + \delta\hat{y}) - \frac{x_1^*}{m_1^*}\hat{k}^*\right], \tag{16}$$

where the coefficients in (16) are evaluated at the equilibrium. With the equilibrium balance of trade in each country, the equilibrium condition (15) will simultaneously bring about the equilibrium of the world market for good 2. It is obvious from (16) that the world price of good 1 is a zeroth degree homogeneous function in the policy measures of the two countries. The domestic prices of good 1 are falling as the level of policy measure is raised in the trading partner and as the endowment of effective capital increases in each country because all of these changes in the parameters create some excess supply of this good in the world market.

III. The Special Interest Groups and the Government

Following the political contributions approach to protection developed by Grossman-Helpman (1994, 1995), this section considers how high the levels of trade-policy measure are determined in the political equilibrium between the owners of capital and the

government in each country under the two distinct international economic regimes. One of them is characterized by no GATT rules and free international capital movement and designated as a pre-GATT regime (hereafter, p-G regime). The other of them, which is designated as a GATT/WTO regime (hereafter, G/W regime), is characterized by free international capital movement and the GATT rules that allow import and export tariffs and prohibit export subsidies as trade-policy measures.

(1) The pre-GATT regime

It is assumed that as in the previous section there are no other income distribution policies except trade policies of subsidies and tariffs and that the participants of the political negotiation are only concerned with the short-run income distribution. The owners of capital demand the encouragement of exports of the capital-intensive good from their government in the home country and the protection of the industry producing this good from their government in the foreign country because they know that capital reward increases as its domestic price is raised. As the return, they are willing to pay political contributions to their own government the amount of which depends on the levels of implemented policy measures because they know that they would be a minority in an election. For these purposes they form a lobby group in each country. The lobby group in the home country (foreign country) claims an increase in the export subsidy (import tariff) to its own government and promises to the political party in power to offer it political contributions, C (C^*), the amount of which depends on the level of an implemented policy measure. Anticipating the levels of policy measures implemented by the home government (foreign government), it decides simultaneously and non-cooperatively the amount of contributions to maximize its net welfare, V (V^*), taking as given the

contributions schedule of the lobby group in the trading partner. Its net welfare is equal to the difference between the total rewards of capital owned in the country and the contributions and represented in the home and foreign countries, respectively, by

$$V = pr_1\overline{K} - C, \quad \text{and} \quad V^* = p^* r_1^* \overline{K}^* - C^*. \tag{17}$$

High government officials who hope carrying the next election expect votes from the citizens and campaign funds from the lobby groups. 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 per capita welfare so that it is crucial for the government to determine which is more important between the per capita welfare and the contributions from the lobby group. Denote the weight that it puts on the former compared with the latter by π, which is hereafter designated as the welfare weight, and assume that it is identical across countries. Facing the contributions schedule of the lobby group, the government determines simultaneously and non-cooperatively the level of policy measure so as to maximize its objective function, taking as given the level of the policy measure implemented by the trading partner government. Its objective function for the home country (foreign country), G (G^*), is the weighted sum of the per capita welfare and the contributions paid by the lobby group and represented, respectively, by

$$G = C + \pi LW \quad \text{and} \quad G^* = C^* + \pi L^* W^*. \tag{18}$$

[Here is Figure 1]

The political equilibrium can be depicted and analyzed in each country using the

indifference maps for the lobby group's net welfare and the government's objective function. For a given value of the welfare weight and a given set of endowments of the effective capital in the home and foreign countries, the indifference curve of V is upward sloping in the (τ, C) coordinate plane because its slope derived from (17) is shown by

$$\left.\frac{dC}{d\tau}\right|_{\bar{V}} = \frac{\partial V}{\partial \tau} = \frac{qX_1\varepsilon^*}{\varepsilon + \varepsilon^*} > 0. \tag{19-a}$$

Assume $\partial^2 V / \partial \tau^2 < 0$, and the set of the indifference curves can be depicted as such curves as V^0V^0 and $V^0V^{0\prime}$ 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 in the same coordinate plane for the given values of the exogenous variables. Its slope is derived from (10-a) and (18):

$$\left.\frac{dC}{d\tau}\right|_{\bar{G}} = -\frac{\pi L \partial W}{\partial \tau} = -\frac{\pi q L m_1 \varepsilon \left\{(\tau - 1)\varepsilon^* + 1\right\}}{\tau(\varepsilon + \varepsilon^*)}. \tag{20-a}$$

It is negative at $\tau = 0$ but positive at $\tau = 1$. It becomes steeper as τ is raised above one, implying that the indifference curve has the 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 $(\tau^{00}, 0)$ in Fig. 1. It may be noted that $\tau^{00} - 1$ which equals $-1/\varepsilon^*$ is the optimum export-tariff rate implemented by the government in the case where no lobby activities exist[1].

The government in the home country can attain level G^0 of its objective function without

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[1] When the volume of trade in good 1 equals zero, and hence each of ε and ε^* becomes an infinity, then $\tau^{00} = 1$, and the lowest point coincides with the point (1, 0).

any contributions from the lobby group, so that it does not accept the objective function lower than G^0. Therefore, it is the reservation level of the objective function. Under such a situation the optimum behavior of the lobby group in this country is to offer the amount of contributions, C^0, so that its indifference curve will be tangent to G^0G^0 and to induce the government to set τ^0, the level of trade-policy measure corresponding to C^0. This means in Fig. 1 that point A, the coordinate of which is (τ^0, C^0), is the equilibrium point between the lobby group and the government. This equilibrium is the Pareto optimum. Reaching this point is equivalent to the behavior of the lobby group to solve implicitly the problem :

$$\max_{C} \quad V$$

$$S.T. \quad C + \pi LW \geq G^0 \quad and \quad C \geq 0.$$

Therefore, the political equilibrium trade-policy measure is represented by

$$\tau^0 = \arg\max[pr_1\overline{K} + \pi LW], \tag{21-a}$$

which is the one that maximizes the joint welfare of the lobby group and the government. It can be derived as a function of τ^{*0}, π and $\tilde{k}/k^*$ by solving (21):

$$\tau^0(\tau^{*0};\ \pi,\ \tilde{k}/k^*) \ = \ \tau^{00}\left[1-\{\pi(\delta-\eta D_1/x_1)\}^{-1}\right]^{-1}. \tag{22-a}$$

This expression shows that the equilibrium level of the home country policy measure is the product of trade interference due to the terms of trade motive which is shown by the policy measure implemented in the case with no lobby activities and trade interference due to the income redistribution motive which is shown by the inverse of one minus the inverse of the welfare weight multiplied by the sum of the supply elasticity and the absolute value of the demand elasticity weighted by the equilibrium ratio of demand to output for good 1 of the home country (The sum is hereafter designated as the home country's weighted sum of the supply and demand elasticity for good 1). It should be noted that τ^0 is a zeroth degree homogeneous

function in the home and foreign endowments of effective capital because so are its components, the price elasticity of foreign country imports and the home country demand-to-output ratio for good 1. If the welfare weight satisfies its feasible condition,

$$\pi > (\delta - \eta D_1 / x_1)^{-1}, \tag{23}$$

then the magnitude of this trade interference is a positive number. Therefore, the equilibrium policy measure is an export subsidy or tariff the rate of which is higher than the optimum export-tariff in the case with no lobby activities. The equilibrium rate is raised under the *ceteris paribus* condition as the government puts a smaller weight on the per capita welfare. The equilibrium levels of policy measures shown in (22-a) and (22-b) below are the special cases of Grossman-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 the trade-policy measure for the foreign country is also determined for a given set of the welfare weight and the relative effective-capital endowments in the same way as in the home country. It is represented as a function of τ^0, π and $\tilde{k}/k^*$:

$$\tau^{*0}(\tau^0;\ \pi,\ \tilde{k}/k^*) \ = \ \tau^{*00}\left[1 - \{\pi(\delta - \eta D_1^* / x_1^*)\}^{-1}\right]^{-1}, \tag{22-b}$$

where τ^{*00} that equals $1+1/\varepsilon$ denotes the optimum policy measure implemented by this country government in the case with no lobby activities (The properties of the indifference curves of the lobby group and the government are seen in Appendix 1). The equilibrium policy measure is a zeroth degree homogeneous function in the home and foreign endowments of effective capital. As long as the welfare weight satisfies the feasible condition (23) it is an import tariff the rate of which is higher than the optimum tariff in the case with no lobby activities. It is raised under the *ceteris paribus* condition as the government puts a smaller weight on the per capita welfare. The results shown in (22) imply that it is more difficult for

any international organization that intends to reduce barriers to trade to prohibit import tariffs than export subsidies in the international economy subject to the political system of protection considered here because the prohibition of import tariffs would always give rise to the opposition of the member countries under the pressures from the domestic lobby groups while the prohibition of export subsidies would not always do so.

Although under the *ceteris paribus* condition the equilibrium policy measures of the foreign and home countries are each an decreasing function in the feasible welfare weight, the ratio between them is an increasing function in it by Assumption 1. This can be shown by the following relationship derived from (22),

$$\frac{\tau^{*0}(\tau^{0};\ \pi,\ \tilde{k}/k^{*})}{\tau^{0}(\tau^{*0};\ \pi,\ \tilde{k}/k^{*})}=\left[1+\frac{\eta\left(D_1^{*}/x_1^{*}-D_1/x_1\right)}{\left[\pi(\delta-\eta D_1^{*}/x_1^{*})-1\right](\delta-\eta D_1/x_1)}\right]\left(\frac{\tau^{*00}}{\tau^{00}}\right). \qquad (24)$$

The second term in the parentheses on the RHS of (24) is negative and larger than minus one under Assumption 1[1].

(2) The GATT/WTO regime

Under the G/W regime where export subsidies are prohibited and import and export tariffs are allowed as trade-policy measures the home country government is forced not to adopt an export subsidy as its policy measure by the rules. If it anticipates the same level of policy measure of the foreign country government as under the p-G regime, 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 curve $G^0G^{0\prime}$ in Fig.1. Facing this indifference curve, the lobby

[1] The second term in the parentheses on the RHS of (24) is equal to zero if and only if the equilibrium tariff-subsidy ratio coincides with the upper limit of its feasible range.

group of this country maximizes non-cooperatively its welfare by controlling the political contributions offered to the political party in power. The equilibrium is attained at a point on the vertical line $\tau = 1$ where the indifference curve cuts $G^0G^{0\prime}$, implying this equilibrium not to be the Pareto optimum or at a point to the left of the line where the indifference curve is tangent to $G^0G^{0\prime}$, implying this equilibrium to be the Pareto optimum. Let $\pi_0(\tilde{k}/k^*)$ denote the critical value of the welfare weight for which the indifference curve of the lobby group is just tangent to $G^0G^{0\prime}$ on the vertical line $\tau = 1$ at a given relative effective-capital endowment. Then it is represented by

$$\pi_0(\tilde{k}/k^*) = \frac{\varepsilon^*}{\delta - \eta D_1 / x_1}. \tag{25}$$

This expression shows that the critical value of the welfare weight is represented by the ratio of the foreign country's price elasticity of the import to the home country's weighted sum of the supply and demand elasticities for good 1. Using this notation, I can represent the equilibrium policy measure of the home country under the G/W regime as

$$\begin{aligned} &\tau^0(\tau^{*0};\ \pi,\ \tilde{k}/k^*) = 1 \qquad \text{for } \pi < \pi_0(\tilde{k}/k^*), \\ &\tau^0(\tau^{*0};\ \pi,\ \tilde{k}/k^*) \le 1 \qquad \text{for } \pi \ge \pi_0(\tilde{k}/k^*). \end{aligned} \tag{26}$$

If this is an export tariff of zero rates it is a corner solution for the government and the lobby group of the home country except the case with the welfare weight just equal to $\pi_0(\tilde{k}/k^*)$ and otherwise it is an inner solution. The lobby group and the government of the foreign country anticipate the equilibrium policy measure of the trading partner as the one shown in (26) and determine their own equilibrium policy measure and political contributions in the same way as under the p-G regime. Therefore, the policy measure is the same as the one shown in (22-b).

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

Proposition 1. (a) The political equilibrium trade-policy measure of the country that imports the capital-intensive good is an import tariff on it both under the p-G and G/W regimes the level of which is represented by the product of the optimum policy measure in the case with no lobby activities and the inverse of one minus the inverse of the welfare weight multiplied by this country's weighted sum of the supply and demand elasticity for the capital-intensive good.

(b) The political equilibrium trade-policy measure of the country that exports the capital-intensive good is an export subsidy to it under the p-G regime, the level of which is represented by the product of the optimum policy measure in the case with no lobby activities and the inverse of one minus the inverse of the welfare weight multiplied by this country's weighted sum of the supply and demand elasticities for this good, and an export tariff of zero rates under the G/W regime provided that the welfare weight is greater than $\pi_0(\tilde{k}/k^*)$, the value of the welfare weight at which the equilibrium policy measure of this country is an export tariff of zero rates under the p-G regime at a given relative effective-capital endowment; otherwise it is an export tariff under both regimes the level of which is represented in the same way as the export subsidy.

IV. The Tariff Response Functions

It was discussed in the previous section that the home country chooses an export subsidy or tariff under the p-G regime and an export tariff of zero or positive rates under the G/W regime and that the foreign country chooses an import tariff under both regimes as the political equilibrium policy measure on the conditions that the level of policy measure in the trading

partner is constant and that the welfare weight set on the national welfare in the government objective function and the effective-capital endowment of each country are given. It is the order to examine how they are altered when these constant and given variables are changeable. This section considers two problems concerning this question. One of them is the consideration of a tariff response function of each country - how the equilibrium level of policy measure in one country responds to the alteration of the level of policy measure by the trading partner under the conditions that the other exogenous variables are constant and no GATT/WTO rules exist. If the tariff response functions of the home and foreign countries intersect each other the Nash equilibrium exists in the international market for good 1. Another problem discussed in this section is how the Nash equilibrium policy measures are influenced by the uniform alteration of the welfare weight by the governments or the change in the relative effective-capital endowment.

Noting that the equilibrium policy measures of the home and foreign countries shown in (22) are homogeneous functions in the endowments of effective capital, the tariff respond functions of these countries can be represented in the form of implicit functions respectively as:

$$f(\tau^{*0},\ \tau^{0};\ \pi,\ \tilde{k}/k^{*}) = 0,$$

$$f^{*}(\tau^{*0},\ \tau^{0};\ \pi,\ \tilde{k}/k^{*}) = 0. \tag{27}$$

It is assumed that there exists a solution to (27) for a given value of the feasible welfare weight and a fixed relative effective-capital endowment. This is the Nash equilibrium under the p-G regime, where the policy measures of the home and foreign countries are denoted by τ^{N} and τ^{*N}, respectively. Denote also the partial elasticity of the home country tariff response

function with respect to τ^{*0}, π and $\tilde{k}/k^*$ by Φ, Φ_π and Φ_K, respectively and that of the foreign country tariff response function with respect to τ^0, π and $\tilde{k}/k^*$ by Φ^*, Φ^*_π and Φ^*_K, respectively. Then (27) can be rewritten using these elasticities as:

$$\Phi\hat{\tau}^{*0} + (1-\Phi)\hat{\tau}^0 = -\ \Phi_\pi\hat{\pi} + \Phi_K\left[\hat{k} + \delta\hat{\gamma}\ -\ \hat{k}^*\right],$$

$$(1-\Phi^*)\hat{\tau}^{*0} + \Phi^*\hat{\tau}^0 = -\ \Phi^*_\pi\hat{\pi} + \Phi^*_K\left[\hat{k} + \delta\hat{\gamma} - \hat{k}^*\right], \tag{28}$$

where $\Phi_\pi = (\tau^N - \tau^{00})/\tau^{00}$, $\Phi^*_\pi = (\tau^{*N} - \tau^{*00})/\tau^{*00}$, and all coefficients are evaluated at the Nash equilibrium. The relation shown in (24) ensures that Φ_π is not smaller than Φ^*_π for the feasible welfare weight under assumption 1. 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, and Φ_K (Φ^*_K) is represented in terms of Φ and Φ_π (Φ^* and Φ^*_π). If Φ is non-negative Φ_K is negative. If Φ^* is non-positive Φ^*_K is negative (See Appendix 2 for the explicit expressions of Φ, Φ^*, Φ_K and Φ^*_K).

It is known from the results derived in section III that the policy measures of the home and foreign countries are monotonically decreasing functions in the welfare weight under the *ceteris paribus* conditions. This can be described in terms of the partial elasticity of the equilibrium policy measure of each country with respect to the welfare weight. The elasticity for the export subsidy/tariff of the home country can be obtained from the first equation in (28) with $\hat{\tau}^{*0} = 0$ and $\hat{k} + \delta\hat{\gamma} = \hat{k}^*$, and the elasticity for the import tariff of the foreign country from the second equation with $\hat{\tau}^0 = 0$ and $\hat{k} + \delta\hat{\gamma} = \hat{k}^*$, and they are represented, respectively, by

$$\left.\frac{\hat{\tau}^0}{\hat{\pi}}\right|_{\hat{\tau}^{*0}=0} = \frac{\Phi_\pi}{\Phi - 1} < 0, \qquad \text{and} \qquad \left.\frac{\hat{\tau}^{*0}}{\hat{\pi}}\right|_{\hat{\tau}^0=0} = \frac{\Phi^*_\pi}{\Phi^* - 1} < 0. \tag{29}$$

These relationships imply as one of the characteristics of the tariff response functions that Φ and Φ^* are both less than one because Φ_π and Φ^*_π are both positive. It is also known from the results obtained in section III that the tariff-subsidy ratio is an increasing function in the welfare weight under the *ceteris paribus* condition. Its elasticity with respect to the welfare weight can be obtained at the Nash equilibrium by solving the equation system (28) with the relative effective-capital endowment fixed as:

$$\frac{\hat{\tau}^{*N} - \hat{\tau}^{N}}{\hat{\pi}} = \frac{\Phi_\pi - \Phi^*_\pi}{1 - \Phi - \Phi^*}. \tag{30}$$

If this elasticity is assumed to be positive for any feasible welfare weight the results in (30) reveal as another characteristic of the tariff response functions that the sum of Φ and Φ^* is less than one because Φ_π is larger than Φ^*_π unless the equilibrium tariff-subsidy ratio coincides with the upper limit of its feasible range. The results obtained so far can be summarized in the following proposition.

Proposition 2. (a) The partial elasticity of the political equilibrium trade-policy measure with respect to the welfare weight is negative in each country.

(b) If the sum of the partial elasticity of each country's tariff response function with respect to the policy measure of the trading partner is less than one the Nash equilibrium tariff-subsidy ratio is an increasing function in the welfare weight under the p-G regime.

The slopes of the foreign and home country tariff response functions can be determined by applying these results. The former is derived from the first equation in (28) as

$$\left.\frac{d\tau^{*0}}{d\tau^{0}}\right|_{r^{*}} = -\frac{\Phi^{*}\tau^{*0}}{(1-\Phi^{*})\tau^{0}}. \tag{31-a}$$

It is positive or negative in accordance with the condition that Φ^{*}, which is less than one, is negative or positive. When the equilibrium level of policy measure is raised in the trading partner the foreign country responds to it by raising the equilibrium rate of import tariff due to the terms of trade motive because it lowers the home country elasticity of export supply[1]. It responds at the same time to this alteration in τ^{0} by lowering the equilibrium rate of import tariff due to the income redistribution motive because it raises the consumption-to-output ratio of good 1 in the foreign country. When Φ^{*} is negative (positive) the effect of the terms of trade motive outweighs (falls short of) that of the income redistribution motive on the equilibrium rate of import tariff and hence the slope of the foreign country tariff response function is positive (negative). The slope of the home country tariff response function is derived from the second equation in (28) as

$$\left.\frac{d\tau^{*0}}{d\tau^{0}}\right|_{r} = -\frac{(1-\Phi)\tau^{*0}}{\Phi\tau^{0}}. \tag{31-b}$$

It is positive or negative in accordance with the condition that Φ, which is less than one, is negative or positive. It is determined by the same reasons as in the foreign country.

The effects of the change in the relative effective-capital endowment on the Nash equilibrium tariff-subsidy ratio can be obtained by solving (28) with the value of the welfare weight kept constant:

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[1] The increase in τ^{0} expands the output and shrinks the consumption of good 1 in the home country, resulting in the increase in its export by a greater volume than the output. Thus it decreases both the ratio of output to export and that of consumption to export and hence decreases the home country elasticity of export.

$$\frac{\hat{\tau}^{*N}-\hat{\tau}^{N}}{\hat{k}+\delta\hat{\gamma}-\hat{k}^{*}}=\frac{\Phi_{K}^{*}-\Phi_{K}}{1-\Phi-\Phi^{*}}. \tag{32}$$

This shows that it is raised to a greater extent by the increase in the relative effective-capital endowment in a country with a greater relative-capital-endowment elasticity of the tariff respond function, and vice versa.

V. International Capital Movement

The mechanism of international capital movement is introduced in this section before discussing the Nash equilibrium trade-policy measures under the p-G and G/W regimes and the effects of the transition in the trading regime on international trade and capital movement in the next section. International capital movement is regarded to occur in response to the difference in real rental between countries. Specifically, it is supposed that capital flows out of a country with lower real rental, measured with good 1, to a country with higher one and that the volume of international capital flows depends proportionally on the inter-country difference in rental. Moreover, it is assumed that a country's supply of labor and the labor-efficiency ratio, γ, are always fixed. Let $\dot{K}^{*}$ denote the volume of capital flowing into the foreign country per unit time, and the mechanism of international capital movement is represented by

$$\dot{K}^{*}=H(r_{1}^{*}-r_{1}), \qquad H(0)=0, \quad H'(\bullet)>0. \tag{33}$$

It is clear from the analysis of section II that real rental in each country depends only on its domestic price of good 1 and, moreover, is monotonically increasing as it rises. If, therefore, the equilibrium tariff-subsidy ratio is greater than the labor-efficiency ratio, and hence real rental is lower in the home country than in the foreign country, then capital flows into the latter from the former, and vice versa. If it is equal to the labor-efficiency ratio, capital stops to

move across the countries. The notation dK^* is used in place of $\dot{K}^*$ in the following. Let $-dK$ denote the volume of capital flowing out of the home country, then the relationship $dK^* = -dK$ is obtained because the inflow of capital into the foreign country must equal the outflow from the home country in volume. Let dk^* and dk denote the inflow and outflow of capital in per capita terms respectively, then the proportional change of k^* or k equal that of K^* or K, respectively. Thus the relation between them can be represented by

$$\hat{k} = -\frac{(1-\rho)k^*}{\rho k}\hat{k}^*. \tag{34}$$

The world economy will converge to the ultimate situation where the Nash equilibrium tariff-subsidy ratio coincides with the labor-efficiency ratio. It is necessary here as well that the requirements of diversified production and the pattern of trade in the two countries must be met. This implies that under the p-G regime the labor-efficiency ratio must take a value within the feasible range of the tariff-subsidy ratio shown in (13) and that under the G/W regime it must satisfy the relations[1], $1 \le \gamma \le (\tilde{k}/k^*)^{1/(\delta-\eta)}$. Therefore, the requirements for the labor-efficiency ratio to satisfy under both regimes can be summarized:

Assumption 2. The labor-efficiency ratio between the effective-capital-rich and the effective-capital-poor country must satisfy the relation, $1 \le \gamma \le (\tilde{k}/k^*)^{1/(\delta-\eta)}$.

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[1] In order for $\tau^{*N}(\tilde{k}/k^*)/\tau^{N}(\tilde{k}/k^*) = \gamma$ to occur when $\tau^{N}(\tilde{k}/k^*) = 1$, the relations, $\tau^{*N}(\tilde{k}/k^*) = \gamma \ge \tau^{*00} > 1$, must hold.

VI. The Nash Equilibrium Trade-Policy Measures and International Capital Movement

The purposes of this section are twofold. One of them is to consider the Nash equilibrium levels of policy measures of the home and foreign countries under the p-G and G/W regimes for a given set of the welfare weight and the relative effective-capital endowment using the results summarized in propositions 1 and 2. This consideration can also reveal the volume of international capital movement realized at the equilibrium. The other of them is to explore the effects of the transition from the p-G to the G/W regime on the volume of international trade in goods and the volume and direction of international capital movement.

It is obvious from the results in section III that the Nash equilibrium tariff-subsidy ratio must lie in the range that meets the requirements for the trade pattern realized under assumption 1 and the diversified production in both countries. This is its feasible range and reproduced as

$$0 < \tau^{*N} / \tau^{N} \leq \left(\tilde{k} / k^{*} \right)^{1/(\delta - \eta)}. \tag{13}$$

Where it comes in this range for a given relative effective-capital endowment depends on the value of the welfare weight. In order to answer this question it is necessary to introduce some critical values for it. One of them is $\pi_0(\tilde{k}/k^{*})$ at which the Nash equilibrium policy measure of the home country is just an export tariff of zero rates under the p-G regime, and the expression of which has already been shown in (25). The other of them is the value denoted by $\pi_\gamma(\tilde{k}/k^{*})$ at which the Nash equilibrium tariff-subsidy ratio just equals the labor-efficiency ratio under the p-G regime. It is represented by

$$\pi_\gamma(\tilde{k}/k^{*}) = \frac{1}{\tau^{*00} - \gamma\tau^{00}} \left[\frac{\tau^{*00}}{\delta - \eta D_1 / x_1} - \frac{\gamma\tau^{00}}{\delta - \eta D_1^{*} / x_1^{*}} \right]. \tag{35}$$

There are some characteristics of the Nash equilibriums realized at the critical values of the welfare weight to be taken up here. Let $\tau_0^{*N}(\tilde{k}/k^{*})$ ($\tau_0^{N}(\tilde{k}/k^{*})$) denote the policy

measure of the foreign (home) country with $\pi_0(\tilde{k}/k^*)$ at the Nash equilibrium under the two regimes and let $\tau_\gamma^{*P}(\tilde{k}/k^*)$ ($\tau_\gamma^{P}(\tilde{k}/k^*)$) denote the policy measure of the foreign (home) country with $\pi_\gamma(\tilde{k}/k^*)$ at the Nash equilibrium under the p-G regime. Then

$$\tau_\gamma^{P}(\tilde{k}/k^*) = \tau^{00} - \frac{(\tau^{*00} - \gamma\tau^{00})\rho x_1 \varepsilon^*}{\gamma\eta x_1^W},$$

$$\tau_\gamma^{*P}(\tilde{k}/k^*) = \tau^{*00} - \frac{(\tau^{*00} - \gamma\tau^{00})(1-\rho)x_1^* \varepsilon}{\eta x_1^W}. \tag{36}$$

These expressions show that a necessary and sufficient condition for these policy measures to be feasible is that the ratio of τ^{*00} to τ^{00} is greater than γ. Therefore, I assume

Assumption 3. $\tau^{*00}/\tau^{00} > \gamma$ for any τ^{*N}/τ^{N} in its feasible range.

They show further that the Nash equilibrium policy measure of the home country with $\pi_\gamma(\tilde{k}/k^*)$ is an export subsidy under the p-G regime if and only if the labor-efficiency ratio is less than the Nash equilibrium policy measure of the foreign country with $\pi_0(\tilde{k}/k^*)$, which is represented by

$$\tau_0^{*N}(\tilde{k}/k^*) = \tau^{*00} + \frac{\tau^{*00}(\delta - \eta D_1/x_1)}{\varepsilon^*(\delta - \eta D_1^*/x_1^*) - (\delta - \eta D_1/x_1)}. \tag{37}$$

The Nash equilibrium policy measures of the home and foreign countries can be shown under both regimes by drawing the diagram of their tariff response functions in the (τ^0, τ^{*0}) coordinate-plane. In this diagram, the tariff-subsidy ratio is depicted as a ray starting at the origin. Ray $\tau^{*0}/\tau^0 = (\tilde{k}/k^*)^{1/(\delta-\eta)}$ is designated as the upper-limit ray of the feasible

tariff-subsidy ratio (hereafter, ULR), ray $\tau^{*0}/\tau^{0}=\gamma$ as the rental- equalization ray (RER) on which international capital movement stops, and ray $\tau^{*0}/\tau^{0}=1$ as the 45-degree ray. The diagram for τ^{*00} is depicted as an upward-sloping curve starting at the intersecting point between the ULR and horizontal line $\tau^{*0}=1$ because τ^{*00}, which is a decreasing function in the tariff-subsidy ratio as shown in Appendix 2, equals one when international trade in good 1 vanishes. The diagram for τ^{00} is also an upward-sloping curve reaching the intersection between the ULR and the vertical line $\tau^{0}=1$. The possible region of the Nash equilibrium tariff-subsidy ratio is surrounded by the ULR and curves τ^{00} and τ^{*00}. When the governments of all countries commonly adopt a welfare weight equal to $\pi_0(\tilde{k}/k^{*})$ the Nash equilibrium point comes on the vertical line $\tau^{0}=1$ under the p-G regime by the definition. There are two possibilities of whether this equilibrium point lies above the intersection between this vertical line and the RER or below it. If the labor-efficiency ratio takes a value between one and $\tau_0^{*N}(\tilde{k}/k^{*})$, this point lies above it This case will occur when the capital-labor endowment ratio of the home country which meets Assumptions 1 and 2 is so different from that of the foreign country that the ULR lies sufficiently above the RER in the $(\tau^{0},\ \tau^{*0})$ coordinate-plane. Thus this case may be designated as the one with strongly different capital-labor endowments (SD case). If the labor-efficiency ratio is greater than $\tau_0^{*N}(\tilde{k}/k^{*})$ the equilibrium point lies below the intersection. This case will emerge when the capital-labor endowment ratio of the home country is not so different from that of the foreign country that the ULR lies above but close to the RER in the $(\tau^{0},\ \tau^{*0})$ coordinate-plane. Thus this case may be designated as the one with weakly different capital-labor endowments (WD case). I consider the determination of the Nash equilibrium policy measures of the two countries and the volume of international capital movement one by one for these two cases.

(Here is Figure 2)

Before doing so the slope of the tariff response curve in each country is examined at a special case of the Nash equilibrium. We know from the discussion in section IV that it depends on the partial elasticity of the tariff response curve with respect to the trading partner's policy measure. If this elasticity is negative (positive and less than one) the tariff response curve with it is upward sloping (downward sloping). Although its value is not generally definite, the ratio of Φ to Φ^* can be shown to equal minus one times the ratio of τ^{*00} to τ^{00} at the Nash equilibrium on the 45-degree ray (See Appendix 3 for the derivation of this result). This implies that the sign of one country's partial elasticity is opposite to that of the other country's elasticity on this ray and hence so is the slope of the tariff response curve. In order to avoid complications in the analysis it is assumed for a while that the partial elasticity of the foreign country is negative on the 45-degree ray as well as on other rays within the feasible region of the policy measures. Thus every tariff response curve of this country is upward sloping and concave because its slope at a point (τ^{*0}, τ^0) is less than the slope of the ray passing through this point, and that of the trading partner is downward sloping in the feasible region. As will be shown below, this assumption does not matter for results.

(1) The Case with Strongly Different Capital-Labor Endowments

This is the case where the labor-efficiency ratio takes a value between one and $\tau_0^{*N}(\tilde{k}/k^*)$. The tariff response curve of the foreign country with the welfare weight $\pi_0(\tilde{k}/k^*)$, which is denoted by $\tau^{*0})_0$, intersects the tariff response curve of the home country with the same welfare weight, which is denoted by $\tau^0)_0$, at a point on the vertical line $\tau^0 = 1$

above its intersecting point with the RER by the definition. Denote this point by N_0. It is the Nash equilibrium point of the two countries both under the p-G and G/W regimes because under the latter regime this vertical line is a tariff response curve of the home country with an export subsidy before the GATT/WTO is established. It is also obvious from the characteristics of the Nash equilibrium discussed above that the equilibrium policy measure implemented by the home country government with the welfare weight $\pi_\gamma(\tilde{k}/k^*)$ must be an export subsidy under the p-G regime. This requires that the tariff response curve of the home country with this welfare weight, which is denoted by $\tau^0)_\gamma$, must lie to the right of the tariff response curve $\tau^0)_0$, the tariff response curve of the foreign country with the same welfare weight, which is denoted by $\tau^{*0})_\gamma$, must lie above the tariff response curve $\tau^{*0})_0$, and both tariff response curves have an intersection on the RER to the right of the vertical line $\tau^0 = 1$. This implies that $\pi_\gamma(\tilde{k}/k^*)$ is smaller than $\pi_0(\tilde{k}/k^*)$ in this case. Denote the intersecting point by N_γ^P. Then it is the Nash equilibrium point of the countries with the common welfare weight $\pi_\gamma(\tilde{k}/k^*)$ under the p-G regime. The equilibrium tariff-subsidy ratio that equals the labor-efficiency ratio is less than the one at the point N_0. The tariff response curve $\tau^{*0})_\gamma$ also cuts the vertical line $\tau^0 = 1$ at a point. Denote this point by N_γ^G. It is the Nash equilibrium point of the two countries under the G/W regime and located above the point N_0 on this line. Thus the Nash equilibrium tariff-subsidy ratio is greater under the G/W than under the p-G regime for the welfare weight $\pi_\gamma(\tilde{k}/k^*)$.

If the foreign country has a welfare weight that is less than $\pi_0(\tilde{k}/k^*)$ and denoted by $\pi_S(\tilde{k}/k^*)$, then its tariff response curve, which is denoted by $\tau^{*0})_S$, lies above the curve $\tau^{*0})_0$, and the tariff response curve of the home country with the same welfare weight, which is denoted by $\tau^0)_S$, lies to the right of the curve $\tau^0)_0$. If this welfare weight is greater (less)

than $\pi_\gamma(\tilde{k}/k^*)$ at the same time, the curve $\tau^{*0})_S$ lies below (above) the curve $\tau^{*0})_\gamma$, and the curve $\tau^0)_S$ lies to the left (right) of the curve $\tau^0)_\gamma$. The tariff response curves of both countries intersect each other in the feasible region surrounded by the curves $\tau^{*0})_0$, $\tau^{*0})_\gamma$, $\tau^0 = 1$, and the RER when $\pi_S(\tilde{k}/k^*)$ is greater than $\pi_\gamma(\tilde{k}/k^*)$ or in the feasible region surrounded by the curves $\tau^{*0})_\gamma$, $\tau^0 = 1$, the ULR and the RER when it is less than $\pi_\gamma(\tilde{k}/k^*)$. Denote the intersecting point by N_S^P. It is the Nash equilibrium point of these countries under the p-G regime. The equilibrium policy measure is an import tariff for the foreign country and an export subsidy for the home country under this regime. The equilibrium tariff-subsidy ratio is greater than the labor-efficiency ratio and less than the ratio at the point N_0 under this regime when the welfare weight is greater than $\pi_\gamma(\tilde{k}/k^*)$ whereas it is less than the labor-efficiency ratio when the welfare weight is less than $\pi_\gamma(\tilde{k}/k^*)$. The foreign country tariff response curve $\tau^{*0})_S$ also cuts the vertical line $\tau^0 = 1$ at a point. Denote this point by N_S^G. Then it is the Nash equilibrium point under the G/W regime and located above the point N_0 on this line. Here the equilibrium policy measure is an import tariff for the foreign country and an export tariff of zero rates for the home country. Thus the equilibrium tariff-subsidy ratio is greater than the ratio at the point N_0 and hence the ratio at the point N_S^P. It should be noted that under the G/W regime the equilibrium tariff-subsidy ratio for the welfare weight $\pi_S(\tilde{k}/k^*)$ in the case where it is less than $\pi_\gamma(\tilde{k}/k^*)$ is higher than the ratio for the welfare weight $\pi_S(\tilde{k}/k^*)$ in the case where it is greater than $\pi_\gamma(\tilde{k}/k^*)$ because the equilibrium point for the former case lies above the one for the latter case on the vertical line $\tau^0 = 1$.

Using the results on the location of the Nash equilibrium points under both trading regimes, it is now possible to examine the effects of the transition from the p-G to the G/W

regime on the volume of international trade in good 1 and the direction and volume of international capital movement. Let $m_1^*)_0, m_1^*)_S^P$ and $m_1^*)_S^G$ denote the volume of the foreign country import of good 1 at the Nash equilibrium points N_0, N_S^P and N_S^G, respectively, and $\dot{K}^*)_0, \dot{K}^*)_S^P$ and $\dot{K}^*)_S^G$ denote the volume of capital flows from the home to the foreign country at the Nash equilibrium points N_0, N_S^P and N_S^G, respectively. If a welfare weight adopted by the governments of all countries is greater than $\pi_\gamma(\tilde{k}/k^*)$ in the SD case, we have

$$m_1^*)_S^G < m_1^*)_0 < m_1^*)_S^P, \tag{38}$$

$$0 \le \dot{K}^*)_S^P < \dot{K}^*)_0 < \dot{K}^*)_S^G. \tag{39}$$

These relations indicate that the transition in the trading regime reduces the volume of international trade in goods 1 and 2 and increases the volume of capital flows from the home to the foreign country. The direction of international capital movement is the same as the direction of trade in the capital-intensive good, and both are substitutes for each other in the sense that the volume of one of them increases as that of the other decreases, and vice versa. If the welfare weight is less than $\pi_\gamma(\tilde{k}/k^*)$, we have the relation (38) and

$$\dot{K}^*)_S^P < 0 < \dot{K}^*)_0 < \dot{K}^*)_S^G. \tag{40}$$

These relations indicate that the transition in the trading regime reduces the volume of trade and reverses the direction of international capital movement. Capital moves from the foreign to the home country under the p-G regime but moves in the opposite direction under the G/W regime.

These results are summed up in conclusion (A): If, in the SD case, the governments of all countries commonly adopt a welfare weight less than $\pi_0(\tilde{k}/k^*)$ at a given relative effective-capital endowment, (1) the Nash equilibrium policy measure of the country importing the capital-intensive good is an import tariff both under the p-G and G/W regimes; (2)

the Nash equilibrium policy measure of the country exporting it is an export subsidy under the p-G regime and an export tariff of zero rates under the G/W regime; (3) the transition from the p-G to the G/W regime decreases the volume of international trade in goods; (4) if the welfare weight is less than $\pi_0(\tilde{k}/k^*)$ but greater than $\pi_\gamma(\tilde{k}/k^*)$ capital flows internationally in the same direction as trade in the capital-intensive good under both regimes and if it is less than $\pi_\gamma(\tilde{k}/k^*)$ capital flows internationally in the opposite direction to trade in this good at least under the p-G regime; and (5) the transition in the trading regime expands the volume of international capital movement in the same direction as trade in the capital-intensive good and reverses the direction of international capital movement in the opposite direction to it.

In the case where the home and foreign countries have a welfare weight, $\pi_A(\tilde{k}/k^*)$, which is not less than $\pi_0(\tilde{k}/k^*)$, the tariff response curve of the foreign country lies below the curve $\tau^{*0})_0$, and the tariff response curve of the home country lies to the left of the curve $\tau^0)_0$ (not shown in Figure 2). If they have an intersection with each other in the feasible region, it must lie in the region surrounded by the curves τ^{00}, $\tau^{*0})_0$ and the ray passing through the point N_0. Denote this point by N_A. Then it is the Nash equilibrium point of the two countries both under the p-G and G/W regimes because the equilibrium policy measure of the foreign country is an import tariff, that of the home country is an export tariff under the p-G regime, and both are not ruled out by the GATT/WTO rules. The equilibrium tariff-subsidy ratio must not be less than the ratio at the equilibrium point N_0, implying that it is also greater than the labor-efficiency ratio. Therefore, we have the results that are summarized in conclusion (B): If, in the SD case, the governments of all countries commonly adopt a welfare weight not less than $\pi_0(\tilde{k}/k^*)$ at a given relative effective-capital endowment, (1) the Nash equilibrium policy measure of the country importing the

capital-intensive good is an import tariff both under the p-G and G/W regimes; (2) the Nash equilibrium policy measure of the country exporting it is an export tariff under both regimes; (3) the volume of international trade is unchanged by the transition from the p-G to the G/W regime; and (4) capital flows internationally in the same direction as trade in the capital-intensive good under both regimes with an unchanged volume.

(2) The Case with Weakly Different Capital-Labor Ratio

This is the case where the labor efficiency ratio takes a value that is not less than $\tau_0^{*N}(\tilde{k}/k^*)$ at a given relative effective-capital endowment. By the definition, the point N_0 that is an intersecting point between the tariff response curves $\tau^0)_0$ and $\tau^{*0})_0$ lies on the vertical line $\tau^0 = 1$ below its intersecting point with the RER. The equilibrium tariff-subsidy ratio is less than the labor efficiency ratio at this point, implying that $\pi_0(\tilde{k}/k^*)$ is less than $\pi_\gamma(\tilde{k}/k^*)$. Therefore, the tariff response curve of the foreign country $\tau^{*0})_\gamma$ lies below the curve $\tau^{*0})_0$, and the tariff response curve of the home country $\tau^0)_\gamma$ lies to the left of the curve $\tau^0)_0$. If the intersection between them is located in the feasible region this is the Nash equilibrium point of the two countries, which is denoted by N_γ and lies on the RER, both under the p-G and G/W regimes. The equilibrium policy measure is an import tariff for the foreign country and an export tariff for the home country under both regimes.

(Here is Figure 3)

If the governments of all countries commonly adopt a welfare weight that is less than $\pi_0(\tilde{k}/k^*)$ and denoted by $\pi_S(\tilde{k}/k^*)$, then the tariff response curve of the foreign country,

$\tau^{*0})_S$, lies above the curve $\tau^{*0})_0$ and the tariff response curve of the home country, $\tau^0)_S$, lies to the right of the curve $\tau^0)_0$ (not shown in Figure 3). They have an intersection in the feasible region surrounded by the curve $\tau^{*0})_0$, and the ray passing through the point N_0. Denote this point by N_S^P. Then it is the Nash equilibrium point of these countries under the p-G regime. The equilibrium policy measure is an import tariff for the foreign country and an export subsidy for the home country. The equilibrium tariff-subsidy ratio is less than the labor-efficiency ratio because it is less than the ratio at the point N_0. The curve $\tau^{*0})_S$ also cuts the vertical line $\tau^0 = 1$ at a point. Denote this point by N_S^G. Then it is the Nash equilibrium point of the two countries under the G/W regime and located on this vertical line above the point N_0 and below or above its intersecting point with the RER. The equilibrium policy measure is an import tariff for the foreign country and an export tariff of zero rates for the home country under this regime. The equilibrium tariff-subsidy ratio is greater than the one realized under the p-G regime by virtue of the concavity of the curve $\tau^{*0})_S$.

The results on the equilibrium tariff-subsidy ratios realized at the points, N_S^G, N_γ, N_0 and N_S^P reveal the effects of the transition from the p-G to the G/W regime on the volume of international trade and the direction and volume of international capital movement. If the welfare weight $\pi_S(\tilde{k}/k^*)$ is less than $\pi_0(\tilde{k}/k^*)$ but, on the one hand, so close to it that the point N_S^G lies on the vertical line $\tau^0 = 1$ in the interval between the point N_0 and its intersection with the RER, then we have

$$m_1^*)_\gamma \le m_1^*)_S^G < m_1^*)_0 < m_1^*)_S^P, \tag{41}$$

$$\dot{K}^*)_S^P < \dot{K}^*)_0 < \dot{K}^*)_S^G \le 0. \tag{42}$$

These relations indicate that the transition in the trading regime reduces the volumes of trade in goods and capital flows from the foreign to the home country. The direction of international

capital movement is opposite to that of trade in the capital-intensive good, and both are complements to each other in the sense that the volume of one of them increases as that of the other increases, and vice versa. If the welfare weight $\pi_S(\tilde{k}/k^*)$ is, on the other hand, sufficiently less than $\pi_0(\tilde{k}^*/k)$ for the point N_S^G to lie above the intersection between the RER and the vertical line $\tau^0 = 1$, then we have the relation (41) and at the same time

$$\dot{K}^*)_S^P < \dot{K}^*)_0 < 0 < \dot{K}^*)_S^G. \tag{43}$$

These relations indicate that the transition in the trading regime reduces the volume of trade in goods and reverses the direction of international capital movement in the opposite direction to trade in good 1.

The results are summarized in conclusion (C): If, in the WD case, the governments of all countries commonly adopt a welfare weight less than $\pi_0(\tilde{k}/k^*)$ at a given relative effective-capital endowment, (1) the Nash equilibrium policy measure of the country importing the capital-intensive good is an import tariff both under the p-G and G/W regimes; (2) the Nash equilibrium policy measure of the country exporting it is an export subsidy under the p-G regime and an export tariff of zero rates under the G/W regime; (3) the transition from the p-G to the G/W regime decreases the volume of international trade in goods; (4) capital flows internationally in the opposite direction to trade in the capital-intensive good at least under the p-G regime; and (5) the transition in the trading regime reduces the volume of international capital movement flowing in the opposite direction to the trade under the G/W regime as well.

In the case where the home and foreign countries have a welfare weight, $\pi_A(\tilde{k}/k^*)$, which is not less than $\pi_0(\tilde{k}/k^*)$, the tariff response curve of the foreign country lies below the curve $\tau^{*0})_0$, and the tariff response curve of the home country lies to the left of the curve $\tau^0)_0$ (not shown in Figure 3). If they have an intersection with each other in the feasible

region, it must lie either in the region surrounded by the curves $\tau^{*0})_0$, $\tau^{*0})_\gamma$, the RER and the ray passing through the point N_0 for the welfare weight $\pi_A(\tilde{k}/k^*)$ smaller than $\pi_\gamma(\tilde{k}/k^*)$ or in the region surrounded by the curves $\tau^{*0})_\gamma$, the RER, τ^{00} and τ^{*00} for $\pi_A(\tilde{k}/k^*)$ larger than it. Denote this point by N_A. Then this is the Nash equilibrium point both under the p-G and G/W regimes. The equilibrium tariff-subsidy ratio is less than the labor-efficiency ratio but not less than the ratio at the point N_0 for the welfare weight $\pi_A(\tilde{k}^*/k)$ that is smaller than $\pi_\gamma(\tilde{k}^*/k)$ whereas it is greater than both ratios for $\pi_A(\tilde{k}/k^*)$ that is larger than it. Therefore, we have the results that are summed up in conclusion (D): If, in the WD case, the governments of all countries commonly adopt a welfare weight not less than $\pi_0(\tilde{k}/k^*)$ at a given relative effective-capital endowment, (1) the Nash equilibrium policy measure of the country importing the capital-intensive good is an import tariff both under the p-G and G/W regimes; (2) the Nash equilibrium policy measure of the country exporting it is an export tariff both under the p-G and G/W regimes; and (3) the volume of international trade in goods as well as the direction and volume of international capital movement are unchanged by the transition from the p-G to the G/W regime. If the welfare weight, that is not less than $\pi_0(\tilde{k}/k^*)$, is less than $\pi_\gamma(\tilde{k}/k^*)$ capital flows internationally in the opposite direction to trade in the capital-intensive good but otherwise it flows in the same direction as the trade.

If, in place of the assumption put above, the partial elasticity of the foreign country tariff response curve with respect to the trading partner's policy measure is positive but less than one and the corresponding one of the home country is negative, then the tariff response curves of the foreign country are downward sloping, and those of the home country upward sloping in the feasible region of the policy measures. A tariff response curve of the foreign country with a

welfare weight less (greater) than $\pi_0(\tilde{k}/k^*)$ lies to the right (left) of the curve $\tau^{*0})_0$, and a tariff response curve of the home country with a welfare weight less (greater) than $\pi_0(\tilde{k}/k^*)$ lies above (below) the curve $\tau^0)_0$. If the equilibrium policy measure of the home country is an export subsidy under the p-G regime, the equilibrium tariff-subsidy ratio is necessarily greater under the G/W regime than under the p-G regime. Thus the conclusions from (A) to (D) stated above remain true in this case. Regardless of the difference in the capital-labor endowment ratios between the two countries and of the value of the partial elasticity of a country's tariff response curve with respect to the trading partner's policy measure, we can therefore sum up the results at a given relative effective-capital endowment on the Nash equilibrium policy measures of the two countries and on the effects of the transition in the trading regime on the volume of trade in goods and the volume and direction of international capital movement in the following proposition.

Proposition 3.

1. The Nash equilibrium policy measure of the country importing the capital-intensive good is an import tariff.
2. The Nash equilibrium policy measure of the country exporting it is an export subsidy under the p-G regime and an export tariff of zero rates under the G/W regime provided that the welfare weight adopted commonly by the governments of all countries is less than $\pi_0(\tilde{k}/k^*)$, the value of the welfare weight at which the Nash equilibrium policy measure of this country is just an export tariff of zero rates under the p-G regime at a given relative effective-capital endowment. Otherwise, the Nash equilibrium policy measure of this country is an export tariff under both regimes.

3. If the Nash equilibrium policy measure of the country exporting the capital-intensive good is initially an export subsidy (export tariff) the transition from the p-G to the G/W regime decreases (does not alter) the volume of international trade.
4. (a) If the welfare weight adopted by the governments of all countries is greater than $\pi_\gamma(\tilde{k}/k^*)$, the value of the welfare weight at which the Nash equilibrium tariff-subsidy ratio equals the labor-efficiency ratio under the p-G regime at a give relative effective-capital endowment, capital flows internationally in the same direction as trade in the capital-intensive good under both regimes. (b) Otherwise, capital flows internationally in the opposite direction to the trade at least under the p-G regime.
5. If the Nash equilibrium policy measure of the country exporting the capital-intensive good is initially an export subsidy (export tariff) the transition in the trading regime increases (does not alter) the volume of international capital movement in the same direction as trade in the capital-intensive good but reduces (does not alter) the volume of international capital movement in the opposite direction to the trade.

According to 3 of this proposition, the transition from the p-G to the G/W regime does not increase the volume of international trade. This conclusion will serve to explain the paradoxical results obtained by Rose (2002) that the GATT/WTO does not systematically contribute to the expansion of international trade by the member countries. According to 4 (a) of the proposition, the transition in the trading regime also increases the volume of international capital movement from the country exporting the capital-intensive good to the country importing it provided that the policy measure of the exporting country is an export subsidy under the p-G regime. If the welfare weight adopted by the governments of all countries is

greater than the critical value π_γ and less than the other critical value π_0 at a given relative effective-capital endowment, then capital flows internationally, according to 2 and 4 (a) of the proposition, in the same direction as trade in the capital-intensive good, and at the same time the exporting country chooses the export subsidy as its equilibrium policy measure under the p-G regime. This implies that the transition in the trading regime increases the volume of international capital movement. These results will serve to explain the expansion in international capital movement witnessed after the World War II[1].

VII. The Welfare Effects of the Transition in the Trading Regime

In the last section we considered the Nash equilibrium policy measures of the home and foreign countries under the p-G and G/W regimes at a given relative effective-capital endowment and the effects of the transition in the trading regime from the former to the latter on the volume of international trade in goods and the direction and volume of international capital movement. In this section we explore the level of world welfare realized at the Nash equilibrium under each trading regime to show that the transition is most likely to reduce it at a given relative effective-capital endowment. This is the instantaneous welfare effect of the transition. We also show that this fall in the level of world welfare cannot be necessarily fully compensated by the expansion in international capital movement created by the transition. This is the total welfare effect of the transition.

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[1] According to Dunning (1983), the accumulated amount of foreign direct investment (FDI) was $14.30 billion in 1914, and $26.35 billion in 1938 around the world, implying that the FDI conducted in the twenty-four years from 1914 to 1938 is regarded as more than $12.05 billion. The accumulated amount of FDI was $66.7 billion in 1960 and $392.8 billion in 1978, implying that the FDI in the eighteen years from 1960 to 1978 is regarded as more than $326.1 billion. The amount is about twenty-seven times as large as that of the FDI between 1914 and 1938.

In order to discuss these issues the level of world welfare, y, is defined as the weighted average of the per capita welfare of the home and foreign countries, $\rho W + (1-\rho)W^*$ (ρ is the share of the home country labor supply in the world total). Then it is represented by

$$y = 1 + \rho p\left[\frac{\eta}{1+\eta}D_1 - \frac{\delta}{1+\delta}x_1\right] + (1-\rho)p^*\left[\frac{\eta}{1+\eta}D_1^* - \frac{\delta}{1+\delta}x_1^*\right]. \tag{44}$$

Its relation with the tariff-subsidy ratio and the relative effective-capital endowment at a fixed labor-efficiency ratio can be derived using (16) and (34) as

$$dy = Q_{YT}(\hat{\tau}^{*0} - \hat{\tau}^0) + Q_{YK}\hat{k}^*, \tag{45}$$

where Q_{YT} denotes its partial elasticity with respect to the political equilibrium tariff-subsidy ratio, and Q_{YK} its partial elasticity with respect to the relative capital endowment. They are represented, respectively, by

$$Q_{YT} = -\frac{(1-\rho)pm_1^*\varepsilon\varepsilon^*}{\varepsilon+\varepsilon^*}\left(\frac{\tau^{*0}}{\tau^0} - 1\right), \tag{46}$$

$$Q_{YK} = \frac{(1-\rho)k^*}{(1+\delta)(\varepsilon+\varepsilon^*)}\left[\frac{x_1(p\varepsilon + p^*\varepsilon^*)}{\tilde{k}}\left[\left(\frac{\tau^{*0}}{\tau^0}\right)^{\delta} - \gamma^{\delta}\right] + \delta p\left(\frac{\varepsilon^* x_1}{k} + \frac{\varepsilon x_1^*}{k^*}\right)\left(1 - \frac{\tau^{*0}}{\tau^0}\right)\right] \tag{47}$$

Obviously, $Q_{YT} \geq (<)0$ according as $\tau^{*0}/\tau^0 \leq (>)1$, and $Q_{YK} < 0$ for $1 \leq \tau^{*0}/\tau^0 \leq \gamma$.

The graph of the level of world welfare can be depicted in the (τ^{*0}/τ^0, y) coordinate-plane using these results at a given set of the welfare weight and the relative effective-capital endowment. They indicate that the curve of y is upward sloping for the equilibrium tariff-subsidy ratio less than one, reaches its maximum point at the ratio equal to one and that it is downward sloping for the ratio greater than one, approaching to a value $y_u(\tilde{k}/k^*)$ as the ratio approaches to its upper limit, $(\tilde{k}/k^*)^{1/(\delta-\eta)}$ (The expression of $y_u(\tilde{k}/k^*)$ and its relationship with the relative capital endowment are seen in Appendix 4).

Let $\tilde{k}_0$ and k^*_0 denote initial effective-capital endowments of the home and foreign countries, respectively, and y^0 the level of world welfare at these endowments, then the curve for y^0 (hereafter, y^0-curve) is depicted in Figs. 4 and 5.

(Here is Figure 4)

The welfare effects of the transition from the p-G to the G/W regime can be derived using these figures. In the case where the Nash equilibrium policy measure of the home country is an export subsidy under the p-G regime, the transition in the trading regime raises the equilibrium tariff-subsidy ratio as discussed in the previous section. This is depicted as a shift from $\tau^{*N}/\tau^N)^P$ to $\tau^{*N}/\tau^N)^G$ in these figures under the assumption that it is greater than one. This enlargement in the international price discrepancy decreases world welfare from the level, say, at point A to the level, say, at point B on the y^0-curve as depicted in these figures through the reduction in trade in goods. This is the direct price effect of the transaction[1]. Moreover, world welfare is reduced by the corner-solution effect of the transition

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[1] If the Nash equilibrium under the p-G regime lies, for instance, at point N_S^P in Fig. 2, then the Nash equilibrium under the G/W regime lies at point N_S^G in this figure. Therefore, $\tau^{*N}/\tau^N)^P$ and $\tau^{*N}/\tau^N)^G$ in the text correspond to the policy-measure ratios passing through points N_S^P and N_S^G, respectively. In Fig. 4 the level of world welfare at point A on the y^0-curve corresponds to the weighted sum of the level of the home country welfare at point N_S^P on its tariff response curve $\tau^0)_S$ and the level of the foreign country welfare at the same point on its tariff response curve $\tau^{*0})_S$ in Fig. 2. The level of world welfare at point B on the y^0-curve corresponds to the weighted sum of the level of the home country welfare at point Y_S which is the intersecting point between the curve $\tau^0)_S$ and the ray $\tau^{*N}/\tau^N)_S^G$ and the level of the foreign country welfare at point N_S^G on the $\tau^{*0})_S$ curve in Fig. 2.

because the equilibrium policy measure of the home country is regulated to an export tariff of zero rates by the GATT/WTO rules. This effect can be depicted as a straight fall of world welfare from the level at point B to a lower level for $\tau^{*N}/\tau^{N})^{G}$ (not shown in Figs. 4 and 5). Therefore, the transition in the trading regime worsens world welfare both through the direct price and corner-solution effects at a given effective-capital endowment as long as the equilibrium tariff-subsidy ratio is greater than one. If the welfare weight adopted by the governments takes such a value that it is less than one under the p-G regime, then the policy measure of the home country must be an export subsidy, and the transition in the trading regime shifts the ratio to a value greater than the labor-efficiency ratio in a way that the less the tariff-subsidy ratio under the p-G regime the greater the ratio under the G/W regime as discussed in the previous section. Therefore, it seems that the direct price effect of the transition is disadvantageous in this case as well unless the initial level of world welfare is extremely low, and with its corner-solution effect the transition will reduce the level of world welfare at a given effective-capital endowment. In the case where the Nash equilibrium policy measure of the home country is an export tariff under the p-G regime, it does not affect world welfare because the equilibrium tariff-subsidy ratio is unchanged by it.

The next task of this section is to examine the total welfare effects of the transition in the trading regime and to answer the question whether the expansion in international capital movement created by it can offset fully the deterioration of world welfare due to the instantaneous effect. We consider first the effects of international capital movement on the level of world welfare affected only by the direct price effect of the transition, which is shown as the level of welfare at $\tau^{*N}/\tau^{N})^{G}$ on the y^{0}-curve in Figs. 4 and 5, and second its corner–solution effect on the level of welfare subject to these effects. The welfare effects of

international capital movement are represented by the equation that is obtained by substituting (32) with a fixed labor-efficiency ratio into (45):

$$dy = (Q_{YT}Q_{TK} + Q_{YK})\hat{k}^*, \tag{48}$$

where Q_{TK} denotes the partial elasticity of the equilibrium tariff-subsidy ratio with respect to the relative effective-capital endowment and is represented by

$$Q_{TK} = \frac{k^W(\Phi_K^* - \Phi_K)}{\rho k^*(1-\Phi-\Phi^*)}. \tag{49}$$

Capital movement from the home to the foreign country rotates the ULR toward the RER in Figs. 2 and 3, implying that it causes the equilibrium tariff-subsidy ratio to decrease. International capital movement in the opposite direction, on the other hand, rotates the ULR away from the RER, implying the increase in the ratio. Therefore, we can assume:

Assumption 4. $Q_{TK} < 0$ for any τ^{*0}/τ^0 in its feasible range.

This assumption means that the increase (decrease) in the capital endowment of the relatively effective-capital scarce country shrinks (enlarges) the international price discrepancy.

The equation (48) indicates that the level of world welfare at a point on the y^0-curve is influenced by international capital movement through two routes: (1) the shift of the y^0-curve to a new curve (shift effect) and (2) the change in the equilibrium tariff-subsidy ratio (indirect price effect). The direction and scale of the shift effect are measured by $Q_{YK}\hat{k}^*$. The indirect price effect is shown as a move along the new curve, and the direction and scale are measured by $Q_{YK}Q_{TK}\hat{k}^*$. If the Nash equilibrium policy measure of the home country under the p-G regime is an export tariff, the transition in the trading regime changes nothing. If, on the

other hand, it is an export subsidy the transition changes the volume of international capital movement and worsens world welfare through its instantaneous effect unless the initial level of world welfare is extremely low. Thus we concentrate the consideration on this case.

If capital moves internationally in the opposite direction to trade in good 1 at least under the p-G regime, then the Nash equilibrium tariff-subsidy ratio is less than the labor-efficiency ratio, and the transition from the p-G to the G/W regime reduces the volume of this type of international capital movement as stated in proposition 3. Let k^{*P} and k^{*G} denote the capital-labor ratios of the foreign country under the p-G and G/W regimes after the occurrence of international capital movement, respectively. Then both k^{*P} and k^{*G} are smaller than k_0^* due to the international capital movement, and moreover the former is smaller than the latter ratio due to the reduction in its volume by the transition. Let y^P and y^G denote the levels of world welfare at k^{*P} and k^{*G}, respectively. Then the y-curves for y^0, y^P and y^G are different from each other in location but they intersect each other at τ^{*0}/τ^0 that is equal to the labor-efficiency ratio because here are no shift effects of international capital movement. This intersecting point is shown as point T in Figs. 4 and 5. Both the y^P and y^G-curves lie above the y^0-curve, and moreover the former lies above the latter curve for the equilibrium tariff-subsidy ratio in the range between one and the labor-efficiency ratio because $Q_{YK} < 0$ here as shown above. These curves do not intersect each other for the equilibrium tariff-subsidy ratio less than one because the zero shift effects of international capital movement hold only at τ^{*0}/τ^0 equal to the labor-efficiency ratio. It will be shown below by putting an assumption on the elasticity of world welfare with respect to international capital movement that the y^0-curve lies below both the y^P and y^G-curves with the latter lying above the former curve for the equilibrium tariff-subsidy ratio in the range between the labor-efficiency

ratio and its upper limit.

Now it is possible to explore the total welfare effects of the transition in the trading regime for the case with capital movement from the foreign to the home country. Suppose that the initial Nash equilibrium lies at point A for $\tau^{*N}/\tau^{N})^{P}$ on the y^{0}-curve in Fig. 4 under the assumption that the Nash equilibrium tariff-subsidy ratio is greater than one. The direct price effect of the transition is, as shown above, depicted as the move from this point to, say, point B for $\tau^{*N}/\tau^{N})^{G}$ along this curve in the case with no reversals in the direction of international capital movement. The shift effects of international capital movement are depicted as vertical jumps of the point A to point A' on the y^{P}-curve under the p-G regime and the point B to point B' on the y^{G}-curve under the G/W regime. Its indirect price effects are shown as the moves of the point A' to the right side to a new point, say, point A'' on the y^{P}-curve and the point B' to the right side to a new point, say, point B'' on the y^{G}-curve under assumption 4. Obviously, the level of world welfare at this point will be lower than the level at the point A'' even if the corner-solution effect of the transition is not taken into account. If the transition reverses the direction of this type of international capital movement, the equilibrium under the G/W regime comes to a point at the right side of the point T on the y^{G}-curve due to its direct price effect (not shown in Fig. 4). The level of world welfare at this new equilibrium point will be lower than the level at the point A'' as well even if the corner-solution effect of is not taken into account because it is lower than the level at the point T. The corner-solution effect strengthens the deterioration of world welfare regardless of whether the direction of international capital movement is reversed or not by the transition. The point T is the terminal point for the Nash equilibriums to approach to under both regimes. Here the levels of world welfare are the same under the two regimes because the corner solution

effect diminishes. Therefore, it can be concluded in the case with capital movement from the foreign to the home country that if assumption 4 holds the transition worsens world welfare until the Nash equilibrium point reaches the terminal point. This is most likely true in the case where the initial Nash equilibrium tariff-subsidy ratio is less than one.

In the case where capital moves internationally in the same direction as trade in good 1, the Nash equilibrium tariff-subsidy ratio is greater than the labor-efficiency ratio under the two regimes, and the transition from the p-G to the G/W regime expands international capital movement as stated in proposition 3, making the ranking of the per capita capital endowments of the foreign country $k^{*G} > k^{*P} > k_0^*$. Whether or not the shift effect of international capital movement improves world welfare is not clear in this case. However, we know that in the neighborhood of the upper limit of the equilibrium tariff-subsidy ratio, where τ^{*0}/τ^0 is close to $(\tilde{k}/k^*)^{1/(\delta-\eta)}$, the y^G-curve lies above the y^P-curve, which is in turn lies above the y^0-curve because $dy_u/\hat{k}^* > 0$. Therefore, we may assume:

Assumption 5. $Q_{YK} > 0$ for the political equilibrium tariff-subsidy ratio in the range between γ and $(\tilde{k}/k^*)^{1/(\delta-\eta)}$.

This assumption means that when the direction of international capital movement is the same as that of trade in good 1 its expansion raises the level of world welfare. These y-curves intersect each other at the point T. For the equilibrium tariff-subsidy ratio less than the labor-efficiency ratio both the y^P and y^G-curves lie above the - y^0-curve with the former lying above the latter curve, as in the case discussed above.

(Here is Figure 5)

Fig. 5 shows the total welfare effects of the transition in the trading regime in the case with this type of international capital movement. Suppose the initial Nash equilibrium lies at point A for $\tau^{*N}/\tau^{N})^{P}$ on the y^{0}-curve in this figure. The direct price effect of the transition is depicted as a move from this point to point B for $\tau^{*N}/\tau^{N})^{G}$ along this curve. The shift effects of international capital movement are depicted under assumption 5 as vertical jumps of the point A to point A' on the y^{P}-curve under the p-G regime and the point B to point B' on the y^{G}-curve under the G/W regime. Its indirect price effects are depicted as moves of the point A' to the right side to a new point, say, point A'' on the y^{P}-curve and the point B' to the right side to a new point, say, point B'' on the y^{G}-curve under assumptions 4 and 5. With no corner-solution effects of the transition the level of world welfare at point B'' will be higher (lower) than the level at point A'' provided that the expansion in international capital movement due to the transition is large (small) enough for its welfare-improving effects under the G/W regime to outweigh (fall short of) those under the p-G regime. However, the corner-solution effect may reduce world welfare under the G/W regime to a level lower than the level at point A''. The point T is the terminal point where the levels of world welfare are the same under the two regimes. It can, therefore, be concluded in the case with capital movement from the home to the foreign country that if assumptions 4 and 5 hold the transition in the trading regime does not necessarily improve world welfare in spite of the expansion in international capital movement induced by it. Therefore, we can summarize the conclusions of this section:

Proposition 4.

1. The transition from the p-G to the G/W regime reduces the level of world welfare at a fixed relative effective-capital endowment unless the initial level of world welfare is extremely low (instantaneous welfare effect).
2. If capital moves internationally in the opposite direction to trade in the capital-intensive good at least under the p-G regime and if the elasticity of the equilibrium tariff-subsidy ratio with respect to the relative effective-capital endowment is negative, then the shrinkage in the international capital movement caused by the transition in the trading regime strengthens the deterioration of world welfare due to the instantaneous effect of the transition.
3. If capital moves internationally in the same direction as trade in the capital-intensive good under both regimes and if, in addition to the elasticity condition assumed above, the elasticity of world welfare with respect to the relative effective-capital endowment is positive, the expansion in the international capital movement caused by the transition in the trading regime does not necessarily offset fully its instantaneous welfare-worsening effect.

VIII. Conclusions

This paper has constructed a model with the aspects of the 2x2x2 model with specific capital and the political contributions approach to protection and introduced free international capital movement and the GATT/WTO rules of allowing import and export tariffs and prohibiting export subsidies as trade policy measures into the model to explore the effects of the rules on the volume of trade in goods, direction and volume of international capital movement and world welfare. It has shown first that the Nash equilibrium policy measure of the country which imports the capital-intensive good is an import tariff while that of the country which

exports it is an export subsidy under the pre-GATT regime and an export tariff of zero rates under the GATT/WTO regime provided that the governments of the two countries commonly put a relatively low weight on their own national welfare relative to the political contributions from the domestic lobby group and that otherwise it is an export tariff of a positive rate. It has shown second that if the export subsidy was chosen as the Nash equilibrium policy measure under the pre-GATT regime by the country exporting the capital-intensive good, then the GATT/WTO rules usually reduce the volume of trade and expand (shrink) international capital movement the direction of which is the same as (opposite to) trade in the capital-intensive good by raising the tariff-subsidy ratio while they affect nothing in the case where the export tariff was chosen under the pre-GATT regime. It has shown third that the welfare-improving effects of the expansion in international capital movement do not necessarily exceed the welfare-worsening effects of the reduction in trade in goods and the failure in achieving the Pareto optimum in the domestic political equilibrium as a result of the prohibition of export subsidies. Judging from these results, we can conclude that the GATT/WTO rules taken up here is inconsistent with its objective to improve world welfare as far as concerning the modern world constituted of the countries with representative democracy.

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Appendices

1. The indifference curve for the net welfare of the foreign country lobby group is upward sloping in the (τ^*, C^*) coordinate plane because its slope is derived from (17) as

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

The reservation level of the foreign government objective function is attained on an indifference curve the slope of which is represented by

$$\left.\frac{dC^*}{d\tau^*}\right|_{\bar{G}^*} = -\frac{\pi L^* \partial W^*}{\partial \tau^*} = \frac{\pi q L^* m_1^* \varepsilon^* \{(\tau^* - 1)\varepsilon - 1\}}{\tau^*(\varepsilon + \varepsilon^*)}.$$

The lobby group solves the problem at the political equilibrium:

$$\max_{C^*} \quad V^*$$

$$S.T. \quad C^* + \pi L^* W^* \geq G^{*0} \text{ and } C^* \geq 0.$$

Therefore, the equilibrium trade measure is represented by

$$\tau^{*0} = \arg\max[p^* r_1^* \bar{K}^* + \pi L^* W^*].$$

The solution to this problem is (22-b) in the text.

2. The original of the first equation in (28) can be derived from (22-a) as

$$\hat{\tau}^0 = \hat{\tau}^{00} + \Phi_\pi \left(\frac{\eta D_1 / x_1}{\delta - \eta D_1 / x_1} (\hat{D}_1 - \hat{x}_1) - \hat{\pi} \right). \tag{A-1}$$

Substitution into (A-1) of the following expressions, (A-2) and (A-3),

$$\hat{\tau}^{00} = \tilde{\Phi}(\hat{\tau}^{*0} - \hat{\tau}^0) - \frac{\tilde{\Phi}}{\delta - \eta D_1 / x_1} [\hat{k} + \delta\hat{\gamma} - \hat{k}^*], \tag{A-2}$$

where $\tilde{\Phi} = \dfrac{(1-\rho)(\delta - \eta)\varepsilon x_1^* D_1^*}{\tau^{00} m_1^* x_1^{w} (\varepsilon^*)^2} > 0$ and $x_1^w = \rho x_1 + (1-\rho) x_1^*$, and

$$\hat{D}_1 - \hat{x}_1 = \frac{(1-\rho)m_1^*\varepsilon^*}{x_1^w}(\hat{\tau}^{*0} - \hat{\tau}^0) - \frac{(1-\rho)x_1^*}{x_1^w}[\hat{k} + \delta\hat{\gamma} - \hat{k}^*] \qquad \text{(A-3)}$$

yields the first equation in (28). Therefore,

$$\Phi = -\left(\tilde{\Phi} + \frac{\rho\varepsilon^*\eta D_1}{\varepsilon x_1^w}\Phi_\pi\right),$$

$$\Phi_K = \frac{x_1}{m_1\varepsilon}\left[\Phi + \frac{\rho\eta^2 x_1^* D_1(D_1^*/x_1^* - D_1/x_1)}{x_1^w m_1^*\varepsilon}\Phi_\pi\right].$$

Similarly,

$$\Phi^* = -\left(\tilde{\Phi}^* + \frac{(1-\rho)\varepsilon\eta D_1^*}{\varepsilon^* x_1^w}\Phi_\pi^*\right),$$

$$\Phi_K^* = -\frac{x_1^*}{m_1^*\varepsilon^*}\left[\Phi^* + \frac{\rho\eta^2 x_1 D_1^*(D_1^*/x_1^* - D_1/x_1)}{x_1^w m_1^*\varepsilon^*}\Phi_\pi^*\right],$$

where $\tilde{\Phi}^* = -\dfrac{\rho(\delta-\eta)\varepsilon^* x_1 D_1}{\tau^{*00} m_1 x_1^w \varepsilon^2} > 0.$

3. At the Nash equilibrium point lying on the 45-degree ray, the home and foreign countries must have the welfare weight, $\left(\dfrac{1}{\tau^{*00}-\tau^{00}}\right)\left[\dfrac{\tau^{*00}}{\delta-\eta D_1/x_1} - \dfrac{\tau^{00}}{\delta-\eta D_1^*/x_1^*}\right]$. Therefore,

$$\Phi = \frac{\tau^{*00}-\tau^{00}}{x_1^w\tau^{00}}\left[\frac{x_1(\rho\varepsilon^*)^2}{\varepsilon} - \frac{x_1^*((1-\rho)\varepsilon)^2}{\varepsilon^*}\right]$$

$$= -\Phi^*\tau^{*00}/\tau^{00},$$

because $\Phi_\pi = -\dfrac{\rho x_1\varepsilon^*(\tau^{*00}-\tau^{00})}{\eta x_1^w\tau^{00}}$, $\Phi_\pi^* = -\dfrac{(1-\rho)x_1^*\varepsilon(\tau^{*00}-\tau^{00})}{\eta x_1^w\tau^{*00}}$ and $D_1 = D_1^*$

$= D_1^w = x_1^w$ here.

4. When τ^{*0}/τ^{0} approaches to $\left(\tilde{k}/k^{*}\right)^{1/(\delta-\eta)}$, p and p^{*} approaches to $\left(\mu\tilde{k}\right)^{1/(\eta-\delta)}$ and $\left(\mu k^{*}\right)^{1/(\eta-\delta)}$, respectively. Therefore, y approaches to $y_{\mu}(\tilde{k}/k^{*})$ where

$$y_{\mu}(\tilde{k}/k^{*}) = 1 - \frac{(\delta-\eta)\mu^{\frac{1+\eta}{\eta-\delta}}\left(\rho\tilde{k}^{\frac{1+\eta}{\eta-\delta}} + (1-\rho)k^{*\frac{1+\eta}{\eta-\delta}}\right)}{e^{\eta}(1+\eta)(1+\delta)}.$$

Clearly, $y_{\mu}(\tilde{k}/k^{*})$ is greater than one. Its relation to the relative capital endowment is represented by

$$\frac{dy_{u}}{\hat{k}^{*}} = \frac{(1-\rho)(\mu k^{*})^{(1+\eta)/(\eta-\delta)}}{e^{\eta}(1+\delta)y_{u}} > 0.$$

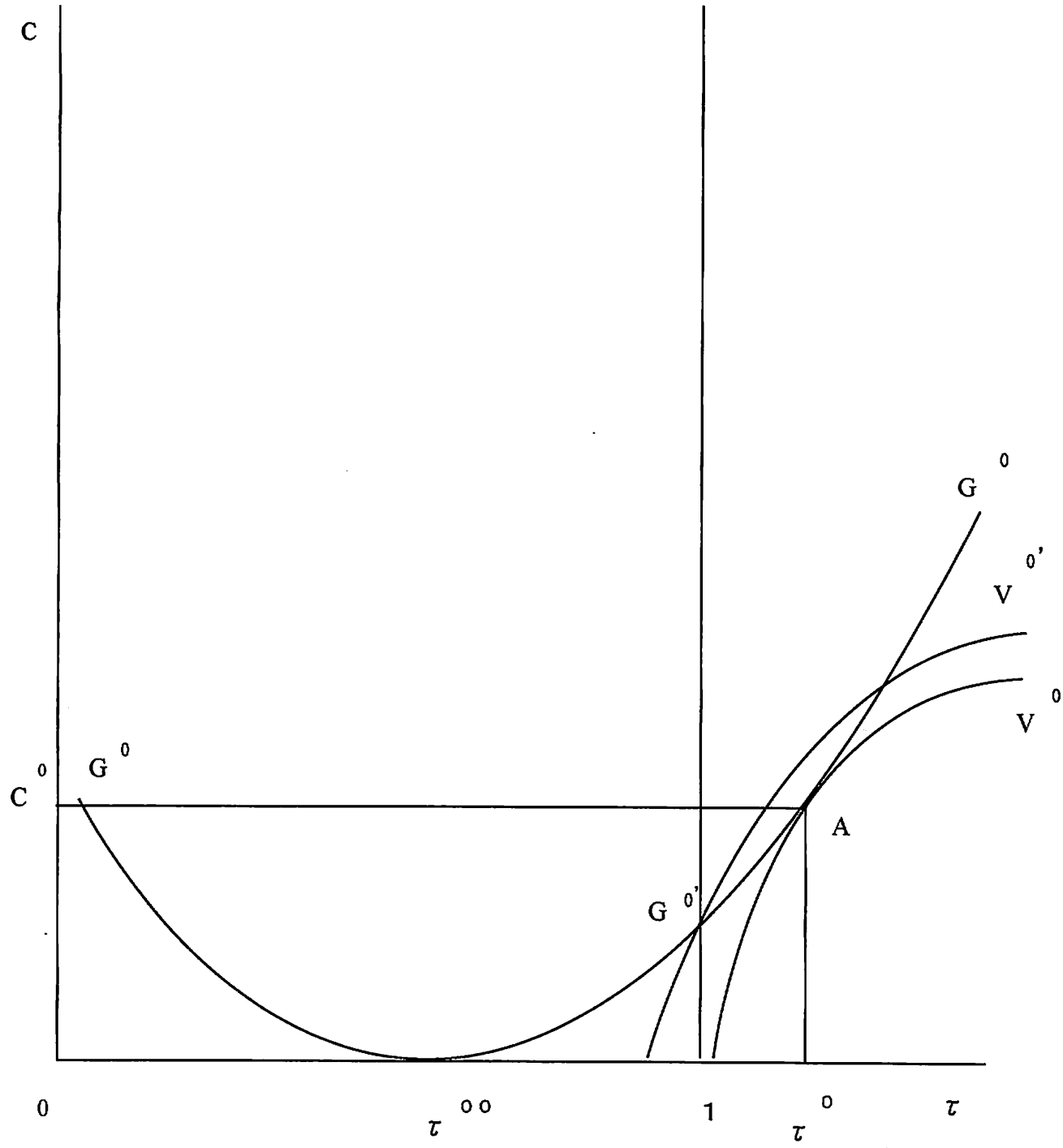

Figure 1

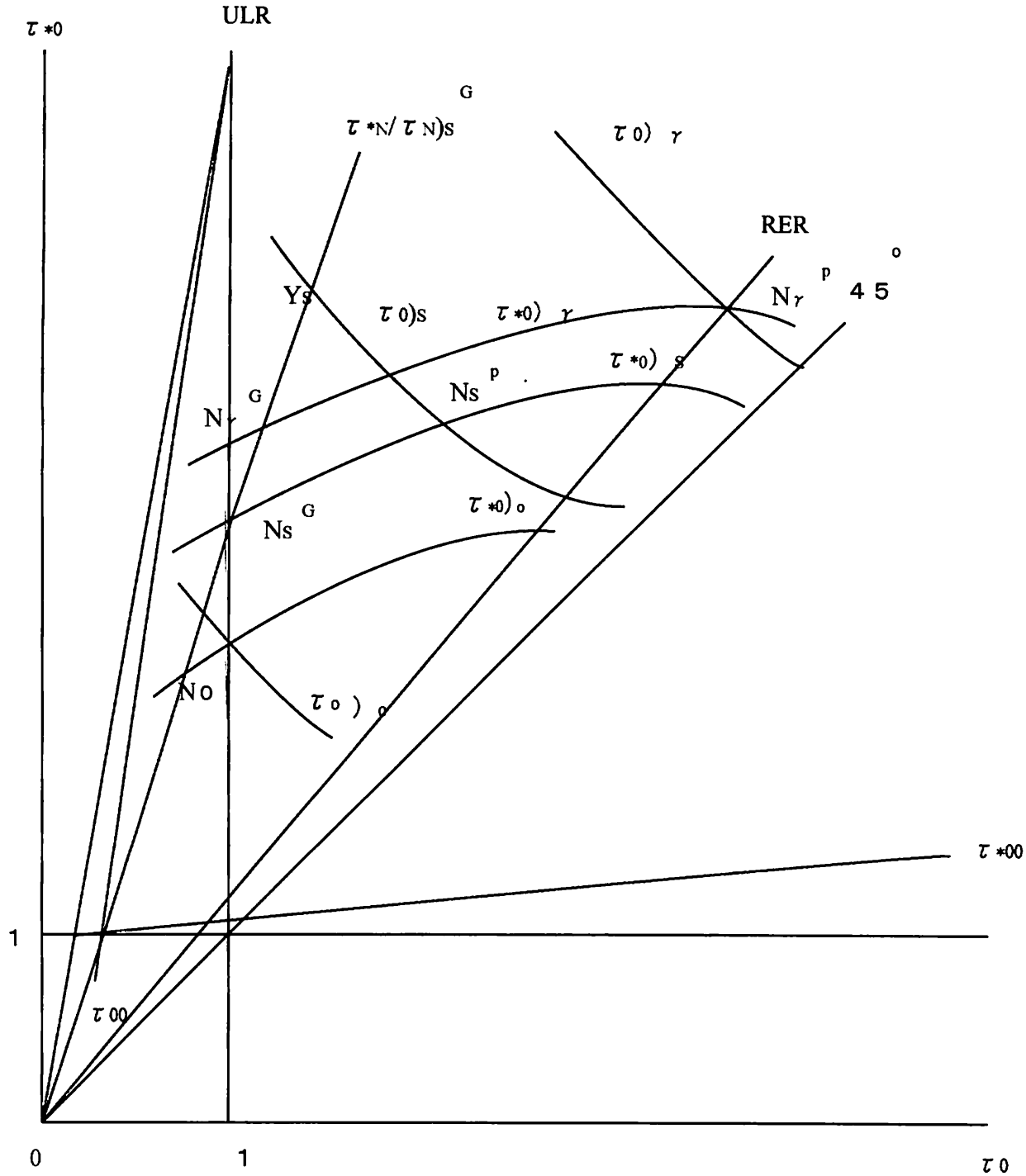
τ*0
ULR
G
τ*N/τN)s
τ0) γ
RER
o
p
45
Ys
τ0)s
τ*0) γ
Nγ
τ*0) s
Ns
p
G
Nγ
G
Ns
τ*0) o
No
τ0) o
τ*00
1
τ00
0
1
τ0

Figure 2

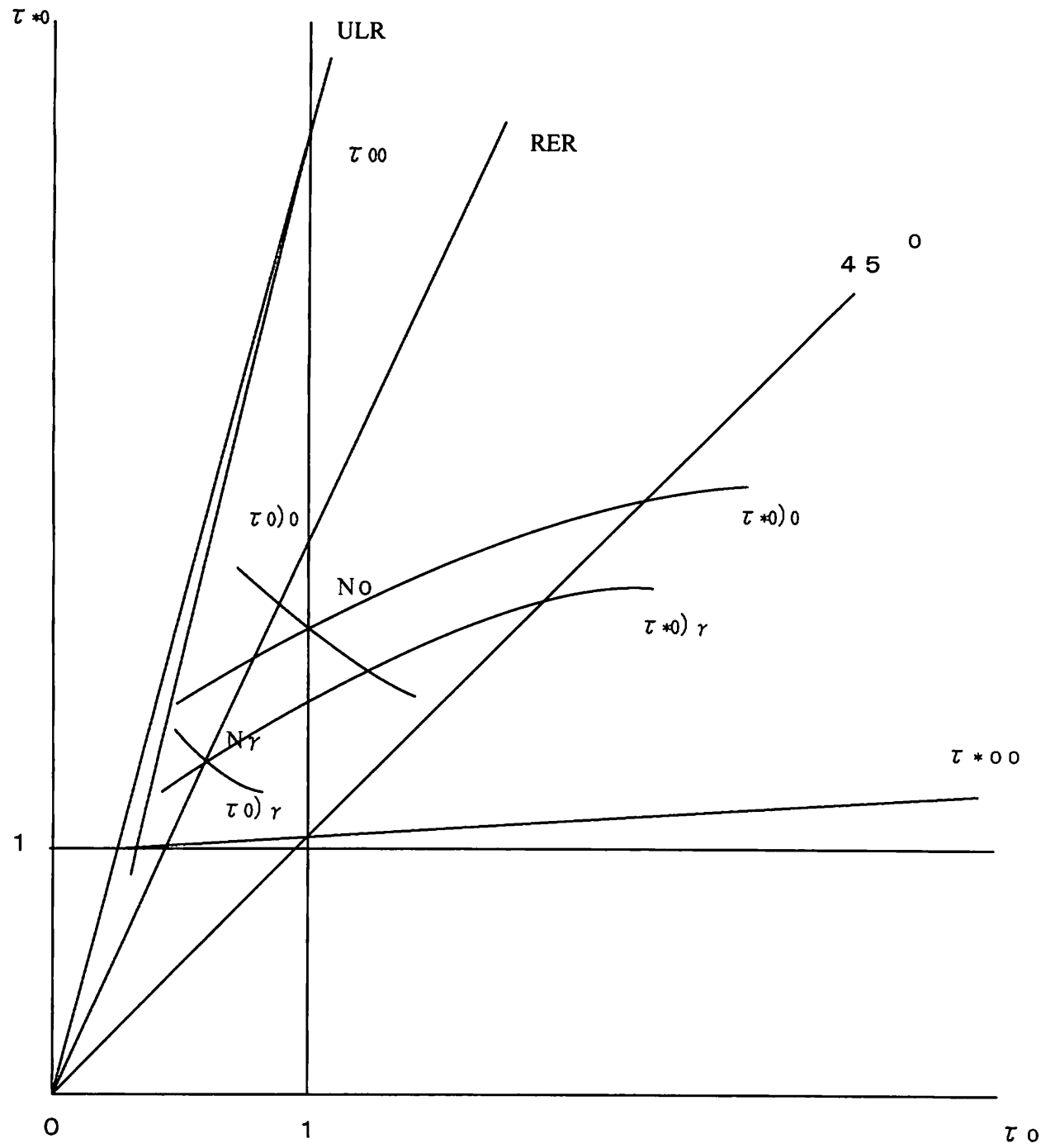

Figure 3

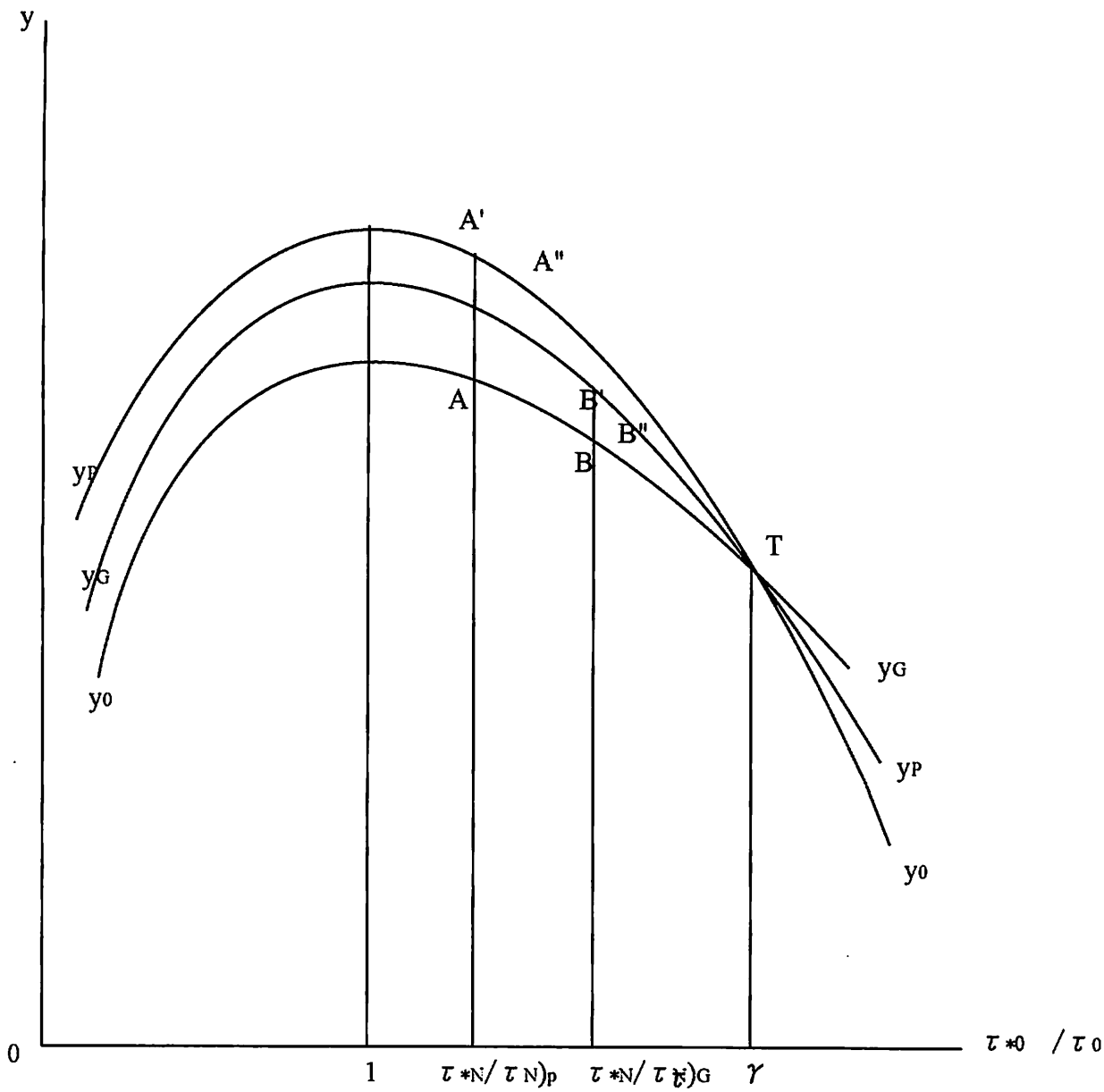

Figure 4

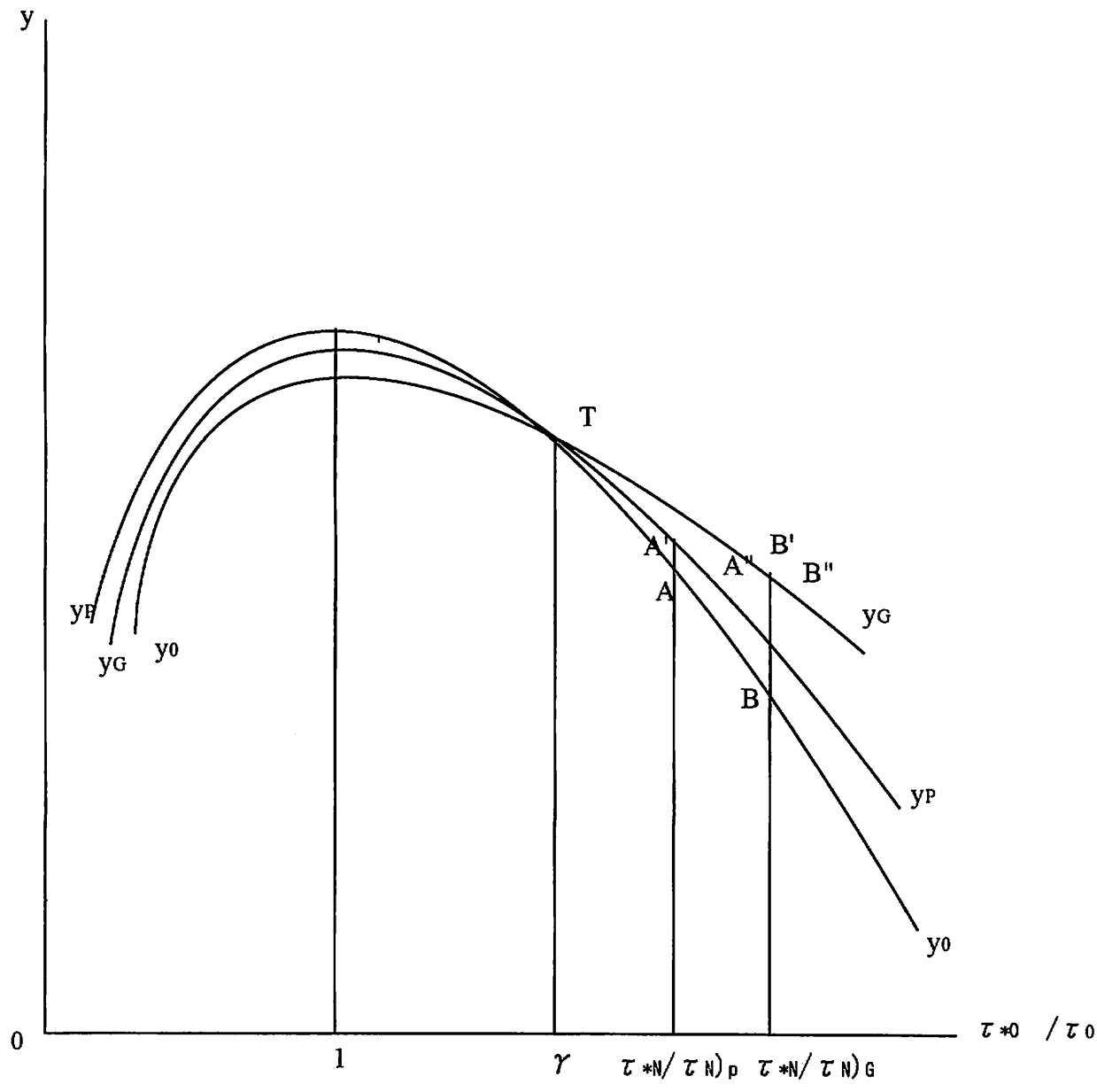

Figure 5