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Abstract

PTAs are generally negotiated without any tariff concessions or transfers to non-member countries. Can such a PTA benefit the neighbors' welfare? In a two-good competitive equilibrium model in the absence of an entrepôt, a PTA without concessions to the outside will hurt the outsider's welfare when goods are normal. If one of the member countries is an entrepôt, however, it definitely improves the neighbors' welfare. In a multiple-good model, a PTA *without concessions* deteriorates the neighbors' welfare, provided that all the goods are normal and substitutes, and that initial tariff levels are small.

Keywords: PTA, Neighbor's Welfare, Kemp-Wan Theorem, WTO, GATT Article 24, Entrepôt

JEL classification: F11, F13, F15

1 Introduction

The world is in a mode of negotiating preferential trade agreements. A preferential trade agreement (PTA) certainly creates trade flows among its members, but it often

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†Koji Shimomura passed away on February 24, 2007 when the substance of this paper had been almost completed. In his last meeting with Koichi Hamada in the Kobe University Hospital, he kept discussing how a Pareto improving PTA could be created.

diverts trade flows from non-member countries. The Most Favored Nation (MFN) principle is the cornerstone for the General Agreement for Tariffs and Trade (GATT). GATT Article XXIV, or at least its current interpretation, offers a "loophole" for the countries that participate in a PTA formation. Can a PTA become beneficial to the rest of the world even though no concessions are made in tariffs or transfers? This paper shows that under a reasonable set of conditions, the formation of a PTA deteriorates the welfare of the neighboring countries unless some concessions are made for the neighboring countries.

Our paper is concerned with the welfare of those countries that are left behind as a result of bilateral liberalization movements. Our curiosity is piqued by the observation in reality that a PTA is seldom, or possibly never, negotiated with a clause that allows concessions to the rest of the world. Legally, as an exception to the MFN rule of GATT, GATT allowed a form of tariff reduction among PTA countries provided only that "the duties and other regulations of commerce imposed at the institution of any such union or interim agreement in respect of trade with contracting parties not parties to such union or agreement shall not on the whole be higher or more restrictive than the general incidence of the duties and regulations of commerce applicable in the constituent territories prior to the formation of such union or the adoption of such interim agreement." (GATT Article XXIV, Section 5). As we will see below, the article, or at least the current interpretation of it, falls far short of providing necessary procedures to keep the welfare of nonmember countries from being hurt by the formation of a PTA.

It is well known through the famous Kemp-Wan theorem (Kemp and Wan, 1976) that a PTA can benefit neighbors as long as tariff concessions or transfers are provided for neighbor countries. In view of the general practice of creating a PTA without compensating outsiders, however, we regard it as a crucial as well as legitimate question to inquire under what conditions a PTA can ever benefit neighbors?

We answer this question mathematically by appleaing to the expenditure-revenue function approach in a general equilibrium competitive model of trade. In a two-commodity formulation where both goods are normal, we show that a Pareto improving PTA is impossible without external tariff concessions to the rest of the world, unless one of the member countries is an "entrepôt." If one of the member countries is an entrepôt, however, formation of a PTA without concessions to the rest of the world definitely improves the welfare of the rest of the world. In other words, in the presence of an entrepôt in the PTA, a formation of a PTA is always Pareto-improving to the world as a whole.

In a general multi-commodity, multi-country models with the Armington assumption that a good is the export of only one country (of origin), if all the goods are normal and substitutes, and if initial tariff levels are small, then a PTA that is negotiated and mutually beneficial for the member countries without compensation to outsiders will necessarily hurt the welfare of outsiders. These conclusions hold even if we allow intra-member transfers between members of a PTA. Incidentally, if countries in the

world adopt the scheme of Bhagwati-Ramasuwami-Srinivasan policy interventions to correct domestic distortions, then the mutually welfare improving tariff reductions without concessions to outsiders will definitely deteriorate the welfare of outsiders, regardless of whether the commodities are mutual substitutes or complements.

Curiously, the conclusion for a two-commodity model is reversed in the presence of the "entrepôt." If one of the members is an "entrepôt," then the formation of a PTA will always be *welfare enhancing* to the neighboring countries and accordingly Pareto-improving to the world. Recently, we see the emergence of prosperous transient ports such as Singapore, Hong Kong, Panama and others, making the best use of their advantageous geographical locations and extensive port facilities. These countries bring trade goods for import and export, and for collection and distribution, internationally. Also we see that those entrepôt countries have very often participated in PTA's themselves or are in the process of negotiating PTA's. There are indeed many reasons that those entrepôt countries tend to negotiate for a member of a PTA, but, one of the reasons may be that a PTA involving an entrepôt is Pareto-improving for the world.

After a short sketch of traditional literature on the welfare effect of a PTA in Section 2, we will present a model based on the expenditure-revenue function and derive the propositions for the difficulty of a Pareto-improving PTA without an entrepôt in Section 3. The welfare enhancing aspect of a PTA involving an entrepôt will be discussed in Section 4. We will discuss the extention of this model to a multiple commodity case by examining its three-good, three-country version in Section 5. Finally, in Section 6, we show the absolute impossibility of forming a Pareto-improving PTA in a world economy where domestic distortions were corrected by proper tax-subsidy schemes (Bhagwati and Ramaswami (1963), Bhagwati, Ramaswami and Srinivasan (1969)), which we call the BRS scheme. The last section concludes the discussions.

2 Bibliographic Sketch

Jacob Viner (1950) originated the ideas of the trade diversion effect and the trade creation effect of a custom union. Our question is tantamount to asking whether the trade diversion effect of a PTA dominates its trade creation effect with respect to the welfare of neighboring countries. We show that trade diversion is likely to dominate trade creation towards the rest of the world, and we explore the exact conditions for the validity of this statement.[1]

In the empirical domain, Winters and Chang (2000) reported that the Spanish accession to the EC reduced the prices of export goods from non-partner countries to Spain relative to those of partners' (EC's) exports. Chang and Winters (2002) also found that the creation of *Mercosur* was associated with significant reductions

[1]Though Viner himself was concerened the welfare effects on the countries participating in an agreement, but the analogy applies clearly to non-member countries as well.

in the nonmembers' terms of trade. Our paper gives a theoretical reason as to why the terms of trade of the rest of the world are likely to deteriorate.

In a model that utilizes calculus, Mundell (1964) addressed a similar issue using the gross-substitutability assumption. The assumption of gross substitutability was crucial there. The results in our paper, however, indicated that the low levels of initial tariff and the (net) substitutability among goods are more important factors in order to assess accurately the outside welfare effect of a PTA. This general equilibrium approach is refined by the use of the expenditure-revenue approach as developed by Dixit and Norman (1980), Woodland (1982), and Bhagwati, Brecher and Hatta (1983, 1985).

Bagwell and Staiger (1999) analyzed a competitive equilibrium, two-sector model of the world economy and successfully convinced us of the importance of WTO's legal structure including the MFN's principle. We focus our attention on the economic impact of a PTA on its neighbors' welfare in the absence of compensations to them. By appealing to the expenditure-revenue function approach, we obtain mathematically clear-cut answers to those questions. Bagwell and Staiger (1997a, 1997b) also analyzed the important issues involving a multicountry situation like us, but most of their results in the last two papers were derived from a partial equilibrium approach.

Most of the previous work derives sufficient conditions for the formation of a Pareto-improving PTA for the world. Panagariya and Krishna (2002), and Riezman and Shimomura (2006) give concrete prescriptions for how to form a Pareto improving PTA. Most of them, however, require some instruments to give concessions to the rest of the world; we preclude the possibility of employing them.[2]

Some of our results demonstrate the impossibility of attaining, under certain conditions, a Pareto improving PTA without concessions to neighboring countries. Kemp and Wan (1976) proved the possibility of a Pareto-improving customs union using the constancy of the terms of trade to outside countries. As mentioned above, we showed the impossibility of a Pareto-improving PTA for the world under the limited availability of policy instruments. In doing this, using the Kemp-Wan methodology to look for constant terms-of-trade toward outsiders turned out to be useful in proving many propositions in our paper. Needless to say, our results do not contradict at all the celebrated Kemp-Wan theorem because in our paper the instruments necessary to achieve their results are precluded by hypothesis.

3 Two-good, Three-country Case

To begin, consider a three-country, two-good model, a familiar model extensively studied by Bagwell and Staiger (1999). Country 1 exports Good 1 to Country 2, Country 2 exports Good 2 to Country 1, and those two countries negotiate mutual

[2]Bond et. al. (2004) also obtains a welfare improving formation of a PTA under oligopolistic assumptions on the trade behavior.

tariff reductions. We neglect, for the sake of simplicity, the effects of transportation costs. Country 0 is the rest of the world in this setting. The trade pattern is important for the following discussions and will be specified below.

Define a "Preferential Trade Agreement (PTA)" as an agreement between two countries, or among several countries, to decrease the tariffs levied on goods imported from participating countries in the agreement. Strictly speaking, this definition is that of "interim PTA" because this definition does not require a complete or near removal of tariffs as often used in the articles of the GATT. Due to the incremental nature of our analysis, however, we have to deal primarily with interim PTA's and call it simply a "preferential trade agreement" throughout this paper.

Denote the specific tariff rate imposed on Good j by Country l on the export of Country k to Country l by t_j^{kl}. The subscript indicates the kind of commodity, the double superscripts indicate the direction of trade, and naturally the second letter indicates the country that imposes the tariff. Tariffs are imposed in the form of "specific tariffs." Since, at the initial point, Country 1 exports Good 1 to Country 2, and Country 2 exports Good 2 to Country 1, Country 1 imposes a tariff t_2^{21} on its import from Country 2 and Country 2 imposes a tariff t_1^{12} on its import from Country 1. Those tariffs are the subject for a negotiation between Country 1 and Country 2 that form a PTA. The specific tariff on the export of Country 0 is notated as t_j^{0l} ($j = 1$ or 2, $l = 1$ or 2), and the specific tariff on the import of Country 0 is t_j^{l0} ($j = 1$ or 2, $l = 1$ or 2).

Let us posit the basic assumptions of this section as follows:

Assumption I: Transportation costs are negligible.

Assumption IIA: Neither the import nor the export of Country 0 is subject to any import tariffs, that is, $t_j^{0l} = 0$, and $t_j^{l0} = 0$. Or,

Assumption IIB: At the initial point, all the tariff rates of all the countries satisfy the most favored nation (MFN) principle such that $t_j^{kl} = t_j^{ml}$, ($j = 1, 2$; $l = 0, 1, 2$; $k \neq m$) where the pair kl corresponds to the available import route.

Assumption III: All the goods are normal, that is, the income effects are positive.

Under Assumption I, and Assumption IIA *or* IIB, both of them seem to be reasonable, the directions of trade flows can be clearly determined. *In the absence of transportation costs (Assumption I), and in the absence of no tariffs on the trade of the rest of the world (Assumption IIA), the relative price of Good 2 in terms of Good 1 in Country 1 is higher than in Country 2 because of the tariffs on Good 1 by Country 2, and the tariff on Good 2 by Country 1.* It is important to notice that the pattern of world trade will become in the direction either portrayed in Figure 1A or 1B.

<Figure 1A and Figure 1B come here>

Remark I. Under Assumption I and IIA, if Country 0 exports Good 2 and imports Good 1, then it will do so only to and from Country 1. In this case (let us call it

Case A), the prices of Country 0 are equal to those in Country 1. There are no trade flows between Country 0 and Country 2.

On the other hand, if Country 0 exports Good 1 and imports Good 2, then it will do so only to and from Country 2. In this case (let us call it Case B), the prices of Country 0 are equal to those in Country 2. There are no trade flows between Country 0 and Country 1.

Similarly, under Assumption I and Assumption IIB, the tariffs on imports are identical wherever the import originates, and the gross incidence of tariffs through an intermediate country (transient port of entrepôt) is higher than that of the tariff from the original producer country. It is less costly for Country 0 to import Good 1 directly from Country 1 than to import Good 1 through Country 2 (Case A), or it is less costly for Country 0 to import Good 2 directly from Country 2 than to import Good 2 through Country 1 (Case B). Thus one can state:

Remark II. Under Assumptions I and IIB, if Country 0 exports Good 2 and imports Good 1, then it will do so only to and from Country 1 (Case A). In this case, the prices of Country 0 are equal to those in Country 2. There are no trade flows between Country 0 and Country 2.

On the other hand, if Country 0 exports Good 1 and imports Good 2, then it will do so only to and from Country 2 (Case B). In this case, the prices of Country 0 are equal to those in Country 1. There are no trade flows between Country 0 and Country 1.

Unless the rest of the world is autarky, either of the above cases, *Case A* or *Case B*, must apply in this two-good model under Assumption I and Assumption IIA or IIB. Invoking Assumption III, we prove our following propositions assuming the world in *Case A*, but our proof can be obtained exactly in the same way in *Case B*, by interchanging the name of Country 1 with Country 2.

To repeat, our basic question is: what is the welfare effect on the outsider country, Country 0, of a PTA formation, that is, the mutually welcomed reduction of tariffs by Country 1 and Country 2, unaccompanied with any tariff reduction of the tariff on the product of Country 0? In other words, how discriminatory can a formation of a PTA be towards the welfare of the rest of the world? We employ calculus for developing our propositions, following the expenditure-revenue approach taken by, for example, Dixit and Norman (1980), Woodland (1982), and Bhagwati, Brecher and Hatta (1983, 1985). For the intuitive explanations, we provide an analysis of the offer curve diagram.

The basic logic used in proving the various theorems on impossibility of the Paretian efficient PTA for the world is as follows. The proof goes as *reductio ad absurdum.* We can assume because of the nature of mutual beneficiary of a PTA that the utility levels of both participating countries are increased. Then assume, on the contrary, the welfare level of the rest of the world were increased. Then, appealing

to the normality of goods, we prove that one of the market equilibrium would not be attained, leading to contradiction.

Let $S^k(p^k, u^k)$ $(k = 0, 1, 2)$; $p^k = (p_1^k, p_2^k)$, be the absorption function, that is, the algebraic difference between the expenditure function $E^k(p^k, u^k)$ to keep the utility level of u^k and the revenue function $F^k(p^k)$. Behind these functions lie basic utility functions $u^0(C_1^0, C_2^0)$, $u^1(C_1^1, C_2^1)$, and $u^2(C_1^2, C_2^2)$ as the utility levels of Countries 0, 1, and 2, respectively. Utilities are defined on their consumption bundles C_j^k's, where C_j^k $(j = 1, 2;\ k = 0, 1, 2)$ indicates consumption of Good j by Country k. $p^k = (p_1^k, p_2^k)$ $(k = 0, 1, 2)$ is the price vector that prevails in the home market in Country k. Define the international price vector that Country 0 faces as $p^* = (p_1^*, p_2^*)$, the ratio of whose two components of the price vector indicates the terms of trade given to the country. In the trade pattern of *Case A,* and under Assumption IIA, namely in the absence of tariffs regarding the import or the export of the rest of the world, $(p_1^*, p_2^*) = (p_1^0, p_2^0) = (p_1^1, p_2^1)$. In the trade pattern of *Case A*, and under Assumption IIB (the MFN initial state), $(p_1^*, p_2^*) = (p_1^0 - t_1^{10}, p_2^0)$ is the price vector that Country 0 faces in the international market.

Let us start our main analysis of the revenue-expenditure system, taking *Case A* as the trade pattern with Assumption IIA. Here, Country 0 and Country 1 share a common price vector. We can take the price vector prevailing in Country 0 and Country 1 as the international vector $p^* = (p_1^*, p_2^*)$.

Given international price vector p^* and tariff vector t^k, the following equation is satisfied.

$$E^0(p^0, u^0) - F^0(p^0) \equiv S^0(p^0, u^0) = 0, \tag{1}$$

$$\begin{aligned} & E^1(p^1, u^1) - F^1(p^1) + t_2^{21}[E_2^2(p^2, u^2) - F_2^2(p^2)] \\ \equiv\ & S^1(p^1, u^1) + t_2^{21} S_2^2(p^2, u^2) = 0, \end{aligned} \tag{2}$$

$$\begin{aligned} & E^2(p^2, u^2) - F^2(p^2) - t_1^{12}[E_1^2(p^2, u^2) - F_1^2(p^2)] \\ \equiv\ & S^2(p^2, u^2) - t_1^{12} S_1^2(p^2, u^2) = 0, \end{aligned} \tag{3}$$

where $E_u^k \equiv \partial E^k/\partial u^k \equiv \partial S^k/\partial u^k$, $F_j^k \equiv \partial F^k/\partial p_j^k$, and $S_j^k \equiv \partial S^k/\partial p_j^k$. $S_j^k \equiv E_j^k - F_j^k$ is the excess demand for Good j by Country k. In view of the trade pattern of *Case A*, we write the system in terms of the international price vector (p_1^*, p_2^*). Moreover, we take the international price of Good 1 as numéraire so that $p_1^* \equiv 1$, and denote the terms of trade of Country 1 as $p_2^* \equiv p_2^*/p_1^*$. From Figure 1A, and using Assumption IIA, one can see that $(1, p_2^*) = (1, p_2^0) = (1, p_2^1)$, and $(p_1^2, p_2^2) = (1 + t_1^{12}, p_2^* - t_2^{21})$. Then this system can be written as:

$$S^0(1, p_2^*, u^0) = 0, \tag{4}$$

$$S^1(1, p_2^*, u^1) + t_2^{21} S_2^2(1 + t_1^{12}, p_2^* - t_2^{21}, u^2) = 0, \tag{5}$$

$$S^2(1+t_1^{12}, p_2^* - t_2^{21}, u^2) - t_1^{12} S_1^2(1+t_1^{12}, p_2^* - t_2^{21}, u^2) = 0, \tag{6}$$

Equations (4), (5) and (6) are the three basic budget constraints for the countries in the world. In addition, we have the two market clearing equations to complete the system. Note that the partial derivative of the absorption function of a country with respect to the domestic price of good j is the excess demand for good j of the country. For example, $S_1^2 \equiv S_1^2(1+t_1^{12}, p_2^* - t_2^{21}, u^2)$ is the excess demand (net import) for Good 1 by Country 2. In light of the Walras law, one of the following equations is redundant because it is implied by the other equations.

$$S_1^0(1, p_2^*, u^0) + S_1^1(1, p_2^*, u^1) + S_1^2(1+t_1^{12}, p_2^* - t_2^{21}, u^2) = 0, \tag{7}$$

$$S_2^0(1, p_2^*, u^0) + S_2^1(1, p_2^*, u^1) + S_2^2(1+t_1^{12}, p_2^* - t_2^{21}, u^2) = 0. \tag{8}$$

We add some additional preliminary remarks. From the zero homogeneity of the excess demand, that is, $S_{i,}^k$ $(k = 0, 1, 2,\ i, j = 1, 2)$, in terms of the domestic prices, we have by the Euler's theorem that

$$\sum_{j=1,2} p_j^k S_{ij}^k = 0, \qquad i, j = 1, 2;\ k = 0, 1, 2, \tag{9}$$

or,

$$\begin{aligned} \sum_{j=1,2} p_j^* S_{ij}^k &= 0, \qquad k = 0, 1;\ i = 1, 2, & (10)\\ (1+t_1^{12}) S_{i1}^2 + (p_2^* - t_2^{21}) S_{i2}^2 &= 0, \qquad i = 1, 2. & (11) \end{aligned}$$

Also from the linear homogeneity of the expenditure function in terms of domestic prices, we have

$$\begin{aligned} E_u^k &= \sum_{j=1,2} p_j^k E_{uj}^k = \sum_{j=1,2} p_j^* E_{uj}^k \qquad k = 0, 1, & (12)\\ E_u^2 &= \sum_{j=1,2} p_j^2 E_{uj}^2 = (1+t_1^{12}) E_{u1}^2 + (p_2^* - t_2^{21}) E_{u2}^2, & (13) \end{aligned}$$

where $E_{uj}^k \equiv \partial E_j^k / \partial u^k$. Of course, we are assuming that $p_1^* = 1$ wherever applicable in the above expressions. We assume *Case A* in the following analysis so that the trade pattern is described as

$$\begin{aligned} S_1^0 &> 0,\ S_1^1 < 0,\ S_1^2 > 0,\ S_1^1 + S_1^2 < 0, & (14)\\ S_2^0 &< 0,\ S_2^1 > 0,\ S_2^2 < 0,\ S_2^1 + S_2^2 > 0. & (15) \end{aligned}$$

We differentiate totally equations (4), (5), (6) and (7) in terms of du^0, du^1, du^2, dp_2^*, and policy instruments dt_1^{12} and dt_2^{21}. Then, we obtain our basic system of comparative statics by eliminating the equilibrium condition of good 2 by the Walras law.

$$\begin{bmatrix} E_u^0 & 0 & 0 & S_2^0 & 0 & 0 \\ 0 & E_u^1 & t_2^{21}E_{u2}^2 & S_2^1 + t_2^{21}S_{22}^2 & t_2^{21}S_{21}^2 & S_2^2 - t_2^{21}S_{22}^2 \\ 0 & 0 & E_u^2 - t_1^{12}E_{u1}^2 & S_2^2 - t_1^{12}S_{12}^2 & -t_1^{12}S_{11}^2 & -S_2^2 + t_1^{12}S_{12}^2 \\ E_{u1}^0 & E_{u1}^1 & E_{u1}^2 & \sum_k S_{12}^k & S_{11}^2 & -S_{12}^2 \end{bmatrix} \begin{bmatrix} du^0 \\ du^1 \\ du^2 \\ dp_2^* \\ dt_1^{12} \\ dt_2^{21} \end{bmatrix} = 0. \tag{16}$$

In their well known paper, Kemp and Wan (1976) showed that if the external price vectors, that is, dp_2^* remain constant, the welfare of the neighbor remains constant while the members' welfare is improved. Though their objective is different from ours in that we aim to show the difficulty of attaining the Pareto improving PTA without explicit concessions to the rest of the world, their analytical device has turned out to be extremely useful. In the following, we will define a combination of tariff changes that keeps the terms of trade constant and call the state of unchanged terms of trade as the "External Terms of Trade Preserving" (ETTP) state, a concept used in the proof of the Kemp-Wan theorem.

Proposition IA: Under Assumptions I, IIA, and III, it is impossible to keep the external price vector constant (ETTP state) if the reciprocal reductions of tariffs between member countries 1 and 2 are mutually beneficial to the member countries.

Proof: Assume the contrary, that there exists a mutually beneficial state, reciprocal reductions of tariffs between Country 1 and country 2, that satisfies $dp_2^* = 0$. It suffices to show that $dp_2^* = 0$ is not compatible to the improving utility levels for country 1 and country 2. The system (16) is then simplified to

$$\begin{bmatrix} E_u^0 & 0 & 0 & 0 & 0 \\ 0 & E_u^1 & t_2^{21}E_{u2}^2 & t_2^{21}S_{21}^2 & S_2^2 - t_2^{21}S_{22}^2 \\ 0 & 0 & E_u^2 - t_1^{12}E_{u1}^2 & -t_1^{12}S_{11}^2 & -S_2^2 + t_1^{12}S_{12}^2 \\ E_{u1}^0 & E_{u1}^1 & E_{u1}^2 & S_{11}^2 & -S_{12}^2 \end{bmatrix} \begin{bmatrix} du^0 \\ du^1 \\ du^2 \\ dt_1^{12} \\ dt_2^{21} \end{bmatrix} = 0. \tag{17}$$

The last equation in this system (17) implies:

$$\sum_{k=0,1,2} E_{u1}^k du^k + S_{11}^2 dt_1^{12} - S_{12}^2 dt_2^{21} = 0. \tag{18}$$

However, one can easily show that the left hand side (L.H.S.) of the equation (18) is positive. For, (i) by the assumption of mutually beneficial state[3], the terms involving du^k is positive, (ii) S^2_{11} is negative and, S^2_{12} is positive by the substitutes assumption. Finally (iii) both $dt^{12}_1$and dt^{21}_2 are negative. Therfore, the last two expressions are positive, and (18) cannot hold. That is a contradiction to our assumption that the market clears with the constant external price vector. *QED.*

One can prove this in the same way in *Case B* as well, by exchanging the naming of countries between Country 1 and Country 2, and of goods between Good 1 and Good 2.

We have shown that as long as both goods are normal (Assumption III), then there will be no mutual concession of tariffs that keeps the terms of trade to the rest of the world constant, or realize the ETTP state. *Proposition I* implies that the ETTP state cannot be achievable by any combination of mutual beneficial concession of tariffs by members of a PTA.

<Figure 2 comes here>

This proposition can be explained intuitively by an offer curve diagram (Figure 2). In Figure 2, the offer curve of Country 0 in terms of the international price vector, $(1, p^*_2)$, or the international terms of trade facing Country 0, p^*_2, is drawn under the assumption of *Case A*. This terms of trade happens to be the common price vector between Country 0 and Country 1 in this case, and is drawn with the combined offer curve of Countries 1 and 2. The initial equilibrium is at P and the international terms of trade prevailing over Country 0 is expressed by the slopes of OP as indicated there. The flatter the slope of OP, the better is the welfare of Country 0. Even after mutual tariff reductions by member countries, Country 0's offer curve remains the same and goes through point P. Suppose the changes in tariffs keep the international terms of trade constant as OP. Since the mutual concession in tariffs improves incomes of Countries 1 and 2, the combined offer curve of Country 1 and Country 2 will move upward, because of the (normal goods) income effects of enhanced utility levels of the members. Accordingly, the intersection of the offer curves will never remain at P.

The proof of *Proposition IA* shows that, as long as income effects are positive, the same external terms of trade creates the excess demand of Good 1 as indicated in the Figure 2. This suggests that the international terms of trade p^*_2 should be lower in the equilibrium and should hurt the welfare of Country 0. The proof of the next proposition in fact demonstrates the validity of this geometrical intuition. One can see the importance of the assumption that the formation of a PTA is mutually beneficial for Country 1 and Country 2 because the proof depends on the fact the income effects for both commodities are positive.

[3]Needless to say, the welfare level of Country 0's utility level does not change because it is in the ETTP state

Even in the case when the terms of trade adjust, we have the following proposition for the case covering variable external terms of trade.

Proposition IIA: Under Assumptions I, IIA, and III, there will be no mutual concessions of tariffs that will improve the welfare of the world in the Paretian sense.

Proof: Assume the contrary that a Pareto improving PTA exists that enhances at least the welfare of one country in the world and keeps the welfare of the other countries constant. Then to keep the welfare of the rest of the world, the international terms of trade facing Country 1 should remain constant or increase, that is,

$$dp_2^* \geq 0 \tag{19}$$

The last equation of the system (16)

$$\sum_{k=0,1,2} E_{u1}^k du^k + \sum_{k=0,1,2} S_{12}^k dp_2^* + S_{11}^2 dt_1^{12} - S_{12}^2 dt_2^{21} = 0, \tag{20}$$

must hold by our hypothesis.

On the other hand, since each country's utility does not decrease ($du^k \geq 0$ for $k = 0, 1, 2$) after the reciprocal tariff reduction between Countries 1 and 2, the first term of the equation remains nonnegative.

$$\sum_{k=0,1,2} E_{u1}^k du^k > 0, \tag{21}$$

Since in the two-good world the goods are always substitutes, S_{12}^k is positive for $k = 0.1.2$. Accordingly, the second term of the above equations,

$$\sum_{k=0,1,2} S_{12}^k dp_2^* \geqq 0 \tag{22}$$

Finally, the third and forth terms of the L.H.S. of equation (20) is, because $dt_1^{12} < 0$ and $dt_2^{21} < 0$,

$$S_{11}^2 dt_1^{12} - S_{12}^2 dt_2^{21} > 0 \tag{23}$$

Inequalities imply that equation (20) cannot be satisfied with equality. This contradicts our initial hypothesis. *QED.*

Next, we will study *Case A* under the Assumption IIB, where the MFN principle is observed initially and the trade pattern is illustrated by Figure 1A. If the tariff reduction is conducted discriminatingly against the non-member country, then a similar analysis follows the analysis that led to Proposition I and Proposition II.

Suppose that the MFN principle is observed initially, but that in the formation of a PTA the member countries neglect the appropriate concession to the rest of the

world. Keeping the notation of the international vector as $(1, p_2^*)$, one can see in this case,

$$\begin{aligned}(p_1^0, p_2^0) &= (1 + t_1^{10}, p_2^*), &(24)\\ (p_1^1, p_2^1) &= (1, p_2^* + t_2^{01}) = (1, p_2^2 + t_2^{21}), &(25)\\ (p_1^2, p_2^2) &= (1 + t_1^{12}, p_2^2) = (1 + t_1^{12}, p_2^* + t_2^{01} - t_2^{21}). &(26)\end{aligned}$$

Please note that before the reciprocal reductions of tariffs between member countries 1 and 2, $t_2^{01} = t_2^{21}$ and therefore $p_2^2 = p_2^*$ from the MFN principle. After the preferential tariff reductions by member countries, however, $t_2^{01} > t_2^{21}$ and therefore $p_2^2 = p_2^* + t_2^{01} - t_2^{21} > p_2^*$. Then this system can be written as:

$$S^0(1 + t_1^{10}, p_2^*, u^0) - t_1^{10} S_1^0(1 + t_1^{10}, p_2^*, u^0) = 0, \tag{27}$$

$$S^1(1, p_2^* + t_2^{01}, u^1) + t_2^{01} S_2^0(1 + t_1^{10}, p_2^*, u^1) + t_2^{21} S_2^2(1 + t_1^{12}, p_2^* + t_2^{01} - t_2^{21}, u^2) = 0, \tag{28}$$

$$S^2(1 + t_1^{12}, p_2^* + t_2^{01} - t_2^{21}, u^2) - t_1^{12} S_1^2(1 + t_1^{12}, p_2^* + t_2^{01} - t_2^{21}, u^2) = 0. \tag{29}$$

Equations (27), (28), and (29) are the three basic budget constraints for the countries in the world. In addition, we have the two-market clearing equations to complete the system.

$$S_1^0(1 + t_1^{10}, p_2^*, u^0) + S_1^1(1, p_2^* + t_2^{01}, u^1) + S_1^2(1 + t_1^{12}, p_2^* + t_2^{01} - t_2^{21}, u^2) = 0, \tag{30}$$

$$S_2^0(1 + t_1^{10}, p_2^*, u^0) + S_2^1(1, p_2^* + t_2^{01}, u^1) + S_2^2(1 + t_1^{12}, p_2^* + t_2^{01} - t_2^{21}, u^2) = 0. \tag{31}$$

By total differentiation in terms of du^0, du^1, du^2, dp_2^*, and policy instruments dt_1^{12} and dt_2^{21},

$$\begin{bmatrix} E_u^0 - t_1^{10} E_{u1}^0 & 0 & 0 & S_2^0 - t_1^{10} S_{12}^0 & 0 & 0 \\ 0 & E_u^1 - t_2^1 E_{u2}^1 & 0 & S_2^1 + t_2^{01} S_{22}^0 + t_2^{21} S_{22}^2 & t_2^{21} S_{21}^2 & S_2^2 - t_2^{21} S_{22}^2 \\ 0 & 0 & E_u^2 - t_1^{12} E_{u1}^2 & S_2^2 - t_1^{12} S_{12}^2 & -t_1^{12} S_{11}^2 & -S_1^2 + t_1^{12} S_{12}^2 \\ E_{u1}^0 & E_{u1}^1 & E_{u1}^2 & \sum_k S_{12}^k & S_{11}^2 & -S_{12}^2 \\ E_{u2}^0 & E_{u2}^1 & E_{u2}^2 & \sum_k S_{22}^k & S_{21}^2 & -S_{22}^2 \end{bmatrix}$$

$$\begin{bmatrix} du^0 \\ du^1 \\ du^2 \\ dp_2^* \\ dt_1^{12} \\ dt_2^{21} \end{bmatrix} = 0. \tag{32}$$

It is easy to see from (32) that the proof of Propositions IA and IIA apply even though there are some initial tariffs on the export and the import of the rest of the world as long as that does not change the trading pattern depicted in Figure 1A (or Figure 1B). The only important assumption is that tariffs related to the export and the import of Country 0 remain the same.

Proposition IB: Under Assumptions I, IIB, and III, it is impossible to keep the external price vector constant (ETTP state) if the reciprocal reductions of tariffs between member countries 1 and 2 are mutually beneficial to the member countries.

Proposition IIB: Under Assumptions I, IIB, and III, there will be no mutual concessions of tariffs that will improve the welfare of the world in the Paretian sense.

Proof: It would suffice to prove Proposition IIB.

Assume the contrary. The market clearing condition of Good 1 in the system (32) is the same as equation (20), that is,

$$\sum_{k=0,1,2} E_{u1}^k du^k + \sum_{k=0,1,2} S_{12}^k dp_2^* + S_{11}^2 dt_1^{12} - S_{12}^2 dt_2^{21} = 0 \tag{33}$$

As long as each country's utility does not decrease ($du^k \geq 0$ for $k = 0, 1, 2$) after the reciprocal tariff reduction (i.e., $dt_1^{12} < 0$ and $dt_2^{21} < 0$,) between Countries 1 and 2, inequality (21) applies. Also inequalities (22) and (23) hold. These inequalities lead to a contradiction to equation (33). *QED.*

Thus, as long as Case A (or Case B) holds for the trade pattern, the welfare effect of a PTA on the rest of the world is generally detrimental without compensating compensation to the rest of the world. In some cases, however, the trade pattern may be drastically different from the above in the presence of high tariffs or transportation costs among countries. We will turn to one of such cases, namely, the case with an "entrepôt" country as a member of a PTA.

4 The Case of Entrepôt

In this model, an "entrepôt" is a country that imports a good from a neighbor country and re-exports at least a part of the same good to another country. There are multiple dimensions of an entrepôt, or a transient port, which started the attention of economists (e.g. Feenstra et. al., 1999, and Feenstra and Hanson, 2004). In our pure model of trade, we focus on the simple but basic feature of an entrepôt, namely, directions of trade through an entrepôt.

Suppose now that there is an entrepôt in the member countries of a PTA as indicated by Figure 1C. In the absence of transportation cost and in the absence of

tariffs on the import or the export of Country 0, we have ascertained that this would not happen as a trade pattern of the world. But if there is a heavy transportation cost between Country 0 and Country 2[4], or if there is a heavy taxation on the import and/or the export between Country 0 and Country 2[5], Country 1 may emerge as an entrepôt. For the generality of discussions, we allow in this case with entrepôt an import tax of Country 0, t_2^{10}.

For example, let us assume Country 1 is an entropôt whose trade pattern is drawn in Figure 1C.

<Figure 1C comes here>

Then, one can state:

Proposition III: Suppose that a member country of a PTA is an "entrepôt" described by the trade flows in Figure 1C. If all the goods are normal (Assumption III), then there is no ETTP state that is compatible with the mutually beneficial PTA of the member countries.

Proof: In this case, the direction of trade between Country 0 and Country 1 is completely reversed from the *Case A*.

$$S_1^0 < 0,\ S_1^1 + S_1^2 > 0, \tag{34}$$
$$S_2^0 > 0,\ S_2^1 + S_2^2 < 0. \tag{35}$$

Thus the decrease in price of Good 2 is now beneficial (rather than harmful) to Country 0. Then the budget constraints of the countries are written as:

$$S^0(1, p_2^* + t_2^{10}, u^0) - t_2^{10} S_2^0(1, p_2^* + t_2^{10}, u^0) = 0, \tag{36}$$

$$S^1(1 + t_1^{01}, p_2^*, u^1) + t_1^{01} S_1^0(1, p_2^* + t_2^{10}, u^0) + t_2^{21} S_2^2(1 + t_1^{01} + t_1^{12}, p_2^* - t_2^{21}, u^2) = 0, \tag{37}$$

$$S^2(1 + t_1^{01} + t_1^{12}, p_2^* - t_2^{21}, u^2) - t_1^{12} S_1^2(1 + t_1^{01} + t_1^{12}, p_2^* - t_2^{21}, u^2) = 0. \tag{38}$$

The system concludes with the market clearing conditions for two commodities where the excess demand functions S_i^k's are properly specified.

$$S_1^0(1, p_2^* + t_2^{10}, u^0) + S_1^1(1 + t_1^{01}, p_2^*, u^1) + S_1^2(1 + t_1^{01} + t_1^{12}, p_2^* - t_2^{21}, u^2) = 0, \tag{39}$$

$$S_2^0(1, p_2^* + t_2^{10}, u^0) + S_2^1(1 + t_1^{01}, p_2^*, u^1) + S_2^2(1 + t_1^{01} + t_1^{12}, p_2^* - t_2^{21}, u^2) = 0. \tag{40}$$

[4]If a country has an excellent port or build an excellent facilities, then it may develop an entrepot. In particular, the existence of indivisibility in transport and resulting increasing returns are the crucial reasons for the emergence of a transient port. In our model, we take the trade pattern through the entropôt as given and analyze its implications.

[5]In absence of transportation cost, the condition $t_2^{21} + t_2^{10} < t_2^{20}$ or $t_1^{01} + t_1^{12} < t_1^{02}$ makes Country 1 an entrepôt. This does not occur when the MFN principle is initially observed.

Then consider that the market equilibrium condition of Good 1 in its total differentiation form will become at the ETTP state ($dp_2^* = 0$),

$$\sum_{k=0,1,2} E_{u1}^k du^k + S_{11}^2 dt_1^{12} - S_{12}^2 dt_2^{21} = 0 \tag{41}$$

With these preparations, assume the contrary to the conclusion of Proposition III. Then, the ETTP state $dp_2^* = 0$ coexists with the improvement of utilities of member countries: $du^k \geq 0$ for $k = 1, 2$ after the reciprocal tariff reduction between Countries 1 and 2. Since $dp_2^* = 0$, $du^0 = 0$, the first term of the equation remains nonnegative.

$$\sum_{k=0,1,2} E_{u1}^k du^k = \sum_{k=1,2} E_{u1}^k du^k > 0, \tag{42}$$

Finally, the second and third terms of the L.H.S. of equation (41) is signed as,

$$S_{11}^2 dt_1^{12} - S_{12}^2 dt_2^{21} > 0 \tag{43}$$

Inequalities imply that equation (41) cannot be satisfied with equality. This contradicts our initial assumption. *QED.*

This is a good news for the world, however. This proof of Proposition III implies that, if we keep the external terms of trade, the market of Good 1 is in excess demand. If the goods market is stable, the equilibrium relative price of Good 1 will increase, or the terms of trade p_2^* will decline. This can be seen intuitively from a diagram of the offer curves like Figure 2. If there is excess demand for Good 1, the equilibrium price ratio will be in favor of Good 1. Since Country 0 exports Good 1 instead of 2 in this entrepôt case, this is a blessing to the rest of the world, provided that the level of tariff is sufficiently small in the presence of an entrepôt.

In order to state *Proposition IV*, we posit the following stability assumption for the market.

Assumption IV: The goods market is (Walrasian) stable.

Then, one can state:

Proposition IV: Suppose that a member country of a PTA is an "entrepôt" described by the trade flows in Case C. Under Assumption III and IV, a creation of a PTA that is mutually beneficial to member countries would definitely enhance the welfare of the rest of the world.

Proof: Since the reciprocal tariff reduction is mutually beneficial, by Proposition III the unchanged external terms of trade ($dp_2^* = 0$) would keep the market of Good 1 in excess demand. By the stability of the market (Assumption IV), this implies that

the change in the equilibrium relative price of Good 2 from the initial price would be in a negative direction, that is, $dp_2^* < 0$.

By the total differentiation of equation (36),

$$(E_u^0 - t_2^{10} E_{u2}^0)du^0 + (S_2^0 - t_2^{10} S_{22}^0)dp_2^* = 0,$$

or,

$$(E_u^0 - t_2^{10} E_{u2}^0)du^0 = -(S_2^0 - t_2^{10} S_{22}^0)dp_2^* \tag{44}$$

On the other hand, because of the linear homogeneity of the expenditure function, by Euler's theorem, $E_u^0 - (p_2^* + t_2^{10})E_{u2}^0 > 0$, and accordingly $E_u^0 - t_2^{10} E_{u2}^0 > 0$. Also, $S_2^0 > 0$ and $S_{22}^0 < 0$, so that $S_2^0 - t_2^{10} S_{22}^0 > 0$. Therefore, the R.H.S. of the equation is positive if $dp_2^* < 0$,and we finally obtain $du^0 > 0$. *QED*

One may provide the following intuitive interpretation of this result. The entrepôt country serves as if it were a semiconductor that connects trade flows. If a PTA is formed around the entrepot, then all the world will be benefited by the more efficient flows of trade through the entrepôt.

Moreover, one can state:

Proposition V: The above results from Proposition I through IV hold even if an intra-member transfer is allowed between Country 1 and Country 2.

We will illustrate its proof in the case of Proposition I. Now the budget constraints of Country 1 and Country 2 become after a transfer from Country 1 to Country 2, T^{12}:

$$S^1(1, p_2^*, u^1) + t_2^{21} S_2^2(1 + t_1^{12}, p_2^* - t_2^{21}, u^2) + T^{12} = 0, \tag{45}$$

$$S^2(1 + t_1^{12}, p_2^* - t_2^{21}, u^2) - t_1^{12} S_1^2(1 + t_1^{12}, p_2^* - t_2^{21}, u^2) - T^{12} = 0. \tag{46}$$

The system in terms of incremental variables is:

$$\begin{bmatrix} E_u^0 & 0 & 0 & 0 & 0 & 0 \\ 0 & E_u^1 & t_2^{21} E_{u2}^2 & t_2^{21} S_{21}^2 & S_2^2 - t_2^{21} S_{22}^2 & 1 \\ 0 & 0 & E_u^2 - t_1^{12} E_{u1}^2 & -t_1^{12} S_{11}^2 & -S_2^2 + t_1^{12} S_{12}^2 & -1 \\ E_{u1}^0 & E_{u1}^1 & E_{u1}^2 & S_{11}^2 & -S_{12}^2 & 0 \end{bmatrix} \begin{bmatrix} du^0 \\ du^1 \\ du^2 \\ dt_1^{12} \\ dt_2^{21} \\ dT^{12} \end{bmatrix} = 0. \tag{47}$$

This does not affect any logical procedures to derive the excess demand for Good 1. Other Propositions can be proved in the same way. Needless to say, the transfer to (or from) Country 0 will definitely help the creation of the Pareto efficient PTA for the world. Certainly transfer to and from the rest of the world does not change the impossibility of the ETTP state, but do directly affect the utility level of Country 0.

5 Multiple-good, Multiple-country Case

Let us generalize our discussions to the N-good model with many country case. By adopting the Armington Assumption that a good is exported by a single country and not re-exported as the same good, we can generalize the above to many-good, many-country case. An important restriction to the analysis is that the rest of the world must be a single country, because it is difficult to make welfare judgment on the rest of the world consisting of many countries.

In order not to overburden the readers with complicated notations, we will proceed to analyze the system of three good and three-country case. Each country exports a single good, and imports two kinds of goods from abroad. Two countries, Country 1 and Country 2 engage in mutually beneficial tariff negotiations to build a PTA. The results to be obtained below can be generalized to any number of member countries in a PTA, and, in particular, to any number of commodities as long as we keep the following Armington assumption.

Throughout the analysis, we assume the following Armington assumption that each commodity is exported by only one country. In a practical domain, this is an assumption that is compatible with the "rules of origin" under the GATT (see Panagariya and Krishna, 2002). Jamaican coffee is distinguished from Colombian coffee as a different commodity under the "rules of origin," and Jamaican coffee re-exported through Panama is still Jamaican coffee, a distinct commodity from both Colombian and Panamanian coffee.

Country k ($k = 0, 1, 2$) exports Good k to two other countries. Country 1, importer of Good 2 and Good 0, and Country 2, importer of Good 1 and Good 0, form a PTA, and Country 0 that imports Good 1 and Good 2 is the rest-of-the-world country that will be left behind from the PTA. The specific tariff rate imposed on the product of Country j by Country k is denoted by t_j^k.[6] At the initial point, Country 1 imposes a tariff t_0^1 on its import from Country 0 (Good 0) and a tariff t_2^1 on its import from Country 2 (Good 2). Country 2 imposes a tariff t_0^2 on its import from Country 0, tariff t_1^2 on its import from Country 1. Similarly, Country 0 imposes a tariff t_1^0 on its import of Good 1 and t_2^0 on import of Good 2. A PTA is formed when Country 1 and Country 2 agree to reduce their tariff rates reciprocally. In the following analysis, for simplicity of exposition, t_1^2 and t_2^1 are the only policy variables and other t_j^k's that involve Country 0 as an exporter or an importer — either j or k is 0 — are assumed to be zero.

Let $u^0(C_0^0, C_1^0, C_2^0)$, $u^1(C_0^1, C_1^1, C_2^1)$, and $u^2(C_0^2, C_1^2, C_2^2)$ be the utility levels of Countries 0, 1, and 2 defined on their consumption bundles C_j^k's, where C_j^k ($j = 0, 1, 2$; $k = 0, 1, 2$) indicates consumption of Good j by Country k. $p^k = (p_0^k, p_1^k, p_2^k)$ ($k = 0, 1, 2$) is the price vector that prevails in the home market in Country k. Define international price vector $p^* \equiv (p_0^0, p_1^1, p_2^2)$ that is the vector of prices at the ports of

[6] We don't need a double superscript to indicate the exporter and importer since Good j comes only from Country j.

origin, and by construction $(p_0^1, p_1^1, p_2^1) = (p_0^0, p_1^1, p_2^2 + t_2^1)$, $(p_0^2, p_1^2, p_2^2) = (p_0^0, p_1^1 + t_1^2, p_2^2)$, and $(p_0^0, p_1^0, p_2^0) = (p_0^0, p_1^1, p_2^2) = p^*$.

Given international price vector p^* and tariff vector t^k, the following equation is satisfied, where $t^0 = (0, 0, 0)$, $t^1 = (0, 0, t_2^1)$, $t^2 = (0, t_1^2, 0)$, and S_j^k is the import of Good j into Country k. Three budget constraints for Countries 0, 1, and 2 are

$$S^0(p^*, u^0) = 0, \tag{48}$$

$$S^1(p^* + t^1, u^1) - t_2^1 S_2^1(p^* + t^1, u^1) = 0, \tag{49}$$

$$S^2(p^* + t^2, u^2) - t_1^2 S_1^2(p^* + t^2, u^2) = 0. \tag{50}$$

The equilibrium conditions in the world market for the commodities are as follows. By the Walras law, one of the three is redundant in that it is automatically satisfied if the other two are satisfied.[7]

$$S_0^0 + S_0^1 + S_0^2 = 0, \tag{51}$$

$$S_1^0 + S_1^1 + S_1^2 = 0, \tag{52}$$

$$S_2^0 + S_2^1 + S_2^2 = 0. \tag{53}$$

Let us designate the international price of Good 0 as the numeraire and let $p_0^* \equiv 1$, and $dp_0^* \equiv 0$. By total differentiation in terms of du^0, du^1, du^2, dp_1^*, dp_2^*, and policy instruments t_1^2 and t_2^1,

$$\begin{bmatrix} E_u^0 & 0 & 0 & S_1^0 & S_2^0 & 0 & 0 \\ 0 & E_u^1 - t_2^1 E_{u2}^1 & 0 & S_1^1 - t_2^1 S_{21}^1 & S_2^1 - t_2^1 S_{22}^1 & 0 & -t_2^1 S_{22}^1 \\ 0 & 0 & E_u^2 - t_1^2 E_{u1}^2 & S_1^2 - t_1^2 S_{11}^2 & S_2^2 - t_1^2 S_{12}^2 & -t_1^2 S_{11}^2 & 0 \\ E_{u0}^0 & E_{u0}^1 & E_{u0}^2 & \sum_k S_{01}^k & \sum_k S_{02}^k & S_{01}^2 & S_{02}^1 \\ E_{u1}^0 & E_{u1}^1 & E_{u1}^2 & \sum_k S_{11}^k & \sum_k S_{12}^k & S_{11}^2 & S_{12}^1 \\ E_{u2}^0 & E_{u2}^1 & E_{u2}^2 & \sum_k S_{21}^k & \sum_k S_{22}^k & S_{21}^2 & S_{22}^1 \end{bmatrix} \begin{bmatrix} du^0 \\ du^1 \\ du^2 \\ dp_1^* \\ dp_2^* \\ dt_1^2 \\ dt_2^1 \end{bmatrix} = 0 \tag{54}$$

From the zero'th homogeneity of the excess demand, that is, S_j^k, in terms of the domestic prices, we have by Euler's theorem that

$$\sum_{j=0,1,2} p_j^k S_{ij}^k = \sum_{j=0,1,2} (p_j^* + t_j^k) S_{ij}^k = 0, \qquad k = 0, 1, 2;\ i, j = 0, 1, 2, \tag{55}$$

[7]Still, it is important to note in the following analysis that all of them are always satisfied.

where p_j^* is the export price of Good j from Country j, that is, the j'th component of the international vector, and t_j^k is identically zero for $j = k$ by the Armington assumption. Also from the linear homogeneity of the expenditure function in terms of domestic prices, we have

$$E_u^k = \sum_{j=0,1,2} p_j^k E_{uj}^k = \sum_{j=0,1,2} (p_j^* + t_j^k) E_{uj}^k, \qquad k = 0, 1, 2. \tag{56}$$

We will assume:

Assumption V: All goods are mutually substitutes.

Assumption VI: All the levels of tariffs are sufficiently small.

Now we will show that the ETTP state is incompatible with the mutually beneficial tariff concessions between the members of a PTA, namely between Countries 1 and 2.

Proposition VI: Under Assumptions III, V and VI, there will be no external terms of trade preserving (ETTP) tariff reductions that are mutually beneficial to member countries, regardless whether transfer payments are allowed between member countries.

Proof: Assume the contrary that there were to exist an equilibrium with $dp_1^* = dp_2^* = 0$ that is compatible with $(du_1, du_2) \geq 0$. First, let us note what the system of equations in case of absence of transfers becomes by eliminating the equilibrium condition for Good 0,

$$\begin{bmatrix} E_u^0 & 0 & 0 & 0 & 0 \\ 0 & E_u^1 - t_2^1 E_{u2}^1 & 0 & 0 & -t_2^1 S_{22}^1 \\ 0 & 0 & E_u^2 - t_1^2 E_{u1}^2 & -t_1^2 S_{11}^2 & 0 \\ E_{u1}^0 & E_{u1}^1 & E_{u1}^2 & S_{11}^2 & S_{12}^1 \\ E_{u2}^0 & E_{u2}^1 & E_{u2}^2 & S_{21}^2 & S_{22}^1 \end{bmatrix} \begin{bmatrix} du^0 \\ du^1 \\ du^2 \\ dt_1^2 \\ dt_2^1 \end{bmatrix} = 0. \tag{57}$$

does not have any non-trivial solution if the 5 by 5 matrix is non-singular. Therefore the proposition is trivially true.

To make the problem more realistic, we allowed in the statement of the proposition that transfers are possible between members. The system is written

$$\begin{bmatrix} E_u^0 & 0 & 0 & 0 & 0 & 0 \\ 0 & E_u^1 - t_2^1 E_{u2}^1 & 0 & 0 & -t_2^1 S_{22}^1 & 1 \\ 0 & 0 & E_u^2 - t_1^2 E_{u1}^2 & -t_1^2 S_{11}^2 & 0 & -1 \\ E_{u1}^0 & E_{u1}^1 & E_{u1}^2 & S_{11}^2 & S_{12}^1 & 0 \\ E_{u2}^0 & E_{u2}^1 & E_{u2}^2 & S_{21}^2 & S_{22}^1 & 0 \end{bmatrix} \begin{bmatrix} du^0 \\ du^1 \\ du^2 \\ dt_1^2 \\ dt_2^1 \\ dT^{12} \end{bmatrix} = 0. \tag{58}$$

Then by hypothesis, there is an equilibrium with tariff changes that preserves the external terms of trade. Multiply the last two equations of the system by p_1^*, and p_2^* and add together. It follows that

$$\sum_{k=0,1,2} (p_1^* E_{u1}^k + p_2^* E_{u2}^k) du^k + (p_1^* S_{11}^2 + p_2^* S_{21}^2) dt_1^2 + (p_1^* S_{12}^1 + p_2^* S_{22}^1) dt_2^1 = 0. \qquad (59)$$

From the zero'th homogeneity of the excess demand functions S_j^k, this is rewritten, noting $p_0^* = 1$,

$$\sum_{k=0,1,2} (p_1^* E_{u1}^k + p_2^* E_{u2}^k) du^k - (S_{01}^2 + t_1^2 S_{11}^2) dt_1^2 - (S_{02}^1 + t_2^1 S_{22}^1) dt_2^1 = 0. \qquad (60)$$

From the assumption of beneficail mutual tax reduction, du's are nonnnegative, and $0 \geq \left[\begin{array}{cc} dt_1^2 & dt_2^1 \end{array} \right]$. Also the sufficiently small tariff levels (Assumption VI) ensures that $\left[\begin{array}{cc} S_{01}^2 + t_1^2 S_{11}^2 & S_{02}^1 + t_2^1 S_{22}^1 \end{array} \right] \geq 0$. Accordingly, the right hand side of the equation is the sum of the positive three terms. This is a contradiction to equation (60). *QED.*[8][9]

A natural question is if it is possible to form a Pareto improving PTA when the terms of trade to the rest of the world is variable.

Proposition VII: Under Assumptions V and VI, there will be no mutual reductions of tariffs that are Pareto beneficial to the world in the absence of any concessions to neighbors.

Proof: There are four kinds of directions for the international prices to move, assuming by convention that the numéraire price does not change, *i.e.,* $dp_0^* = 0$.

Case (i) $(dp_1^*, dp_2^*) \geq 0$:

Case (ii) $(dp_1^*, dp_2^*) = 0$:

Case (iii) One of the pair (dp_1^*, dp_2^*) is positive and the other is negative: $dp_1^* < 0$ and $dp_2^* > 0$; or $dp_1^* > 0$ and $dp_2^* < 0$:

Case (iv) $(dp_1^*, dp_2^*) \leq 0$:

We consider these four cases in turn.

Case (i): This is a typical direction that prices are likely to move. It is realized when the excess demand structures on goods by the three countries are similar (Endoh and Hamada, 2005). Since Country 0 imports Good 1 and Good 2, this move cannot be Pareto improving. The Proposition holds true in this case.

[8]The proposition is in conformity with the Kemp-Wan theorem, because the Kemp-Wan theorem assumes an instrument, common tariffs towards the rest of the world, as a means of keeping the terms of trade. We are in fact reconfirming that the tariff concessions to non-member countries are necessary for the attainment of the ETTP state, a state which was skillfully employed to prove the Kemp-Wan Theorem.

[9]This result can be also proved by applying the Farkas Theorem (Dorfman, Samuelson and Solow, 1958).

Case (ii): Proposition VI indicates that this Proposition holds true for this case.

Case (iii): We will also prove the impossibility of a Pareto improving PTA formation when $dp_1^* < 0$ and $dp_2^* > 0$.

Assume the contrary, that there is a Pareto improving PTA formation, $S_1^0 dp_1^* + S_2^0 dp_2^* \leq 0$ follows in order not to deteriorate the welfare of Country 0.

On the other hand, since the levels of tariffs are sufficiently small, and since neither the import of Good 1 to Country 2 nor the import of Good 2 to Country 1 is zero, then the signs of components of the matrix in the L.H.S. of equation (54)

$$\begin{bmatrix} S_1^1 - t_2^1 S_{21}^1 & S_2^1 - t_2^1 S_{22}^1 \\ S_1^2 - t_1^2 S_{11}^2 & S_2^2 - t_1^2 S_{12}^2 \end{bmatrix}$$

must be the same as those of S_j^k's, because of the assumption of sufficiently small initial tariff levels. That is,

$$sign \begin{bmatrix} S_1^1 - t_2^1 S_{21}^1 & S_2^1 - t_2^1 S_{22}^1 \\ S_1^2 - t_1^2 S_{11}^2 & S_2^2 - t_1^2 S_{12}^2 \end{bmatrix} = sign \begin{bmatrix} S_1^1 & S_2^1 \\ S_1^2 & S_2^2 \end{bmatrix} = \begin{bmatrix} - & + \\ + & - \end{bmatrix}. \tag{61}$$

We have to note that the welfare of Country 2 importing Good 1 will increase when $dp_1^* < 0$ and $dp_2^* > 0$. The welfare of Country 1, however, will definitely deteriorate. This contradicts the successful formation of a mutually beneficial PTA. (Incidentally, the above conditions for the magnitudes of tariffs are equivalent to the conditions that the tariff levels are set to below the revenue maximizing tariff levels.) Those terms involving t_2^1 or t_1^2 have all negative signs, but for sufficiently small t_2^1 and t_1^2, the effect of those terms will be negligible. Thus we obtain the contradiction.

Case (iv): Multiply the last two equations of the system (54) by p_1^* and p_2^* and add up. From the zero'th homogeneity of S_j^k, this is rewritten, assuming $p_0^* = 1$ and $dp_0^* = 0$,

$$\sum_{k=0,1,2} (p_1^* E_{u1}^k + p_2^* E_{u2}^k) du^k - \left(\sum_{k=0,1,2} S_{01}^k + t_2^1 S_{21}^1 + t_1^2 S_{11}^2 \right) dp_1^*$$

$$- \left(\sum_{k=0,1,2} S_{02}^k + t_2^1 S_{22}^1 + t_1^2 S_{12}^2 \right) dp_2^* - (S_{01}^2 + t_1^2 S_{11}^2) dt_1^2 - (S_{02}^1 + t_2^1 S_{22}^1) dt_2^1 = 0 \tag{62}$$

From the assumption of mutual tax reduction, $0 \geq (dt_2^1, dt_1^2)$ and the assumption of sufficiently small t_j^k implies that all the effect of $t's$ in the above expression is dominated by the effects of S_{0j}^k $(j = 1, 2; k = 0, 1, 2)$. Along with the hypothesis $(dp_1^*, dp_2^*) \leq 0$ implies that the L.H.S. of the equation is positive as long as goods are substitutes. This leads us to a contradiction. *QED.*

Curiously, in the case of the existence of complimentarily of the numéraire good, one can also show:

Proposition VIII: If the numéraire good, Good 0, is complementary to the other two traded goods, then, regardless of the levels of initial tariffs, there will be no tariff reductions by member countries that keep the outside terms of trade constant, namely, that would attain the TTPS.

Proof: Take a row vector $(1, 1, 1, -p_1^*, -p_2^*)$ and multiply equation (57) by the vector from the left. Then, by similar calculations of the above, one obtains from the equation that it must hold if the system is valid.

$$\left[\begin{array}{ccc} E_{u0}^0 & E_{u0}^1 & E_{u0}^2 \end{array} \right] \left[\begin{array}{c} du^0 \\ du^1 \\ du^2 \end{array} \right] + \left[\begin{array}{cc} S_{01}^2 & S_{02}^1 \end{array} \right] \left[\begin{array}{c} dt_1^2 \\ dt_2^1 \end{array} \right] = 0. \tag{63}$$

The first term of the left hand side is definitely positive, and the second term is positive by our assumption of complements of Good 0 to the other goods in the two countries, $(S_{01}^2, S_{02}^1) < 0$ and $(dt_2^1, dt_1^2) \leq 0$. This will lead to a contradiction. *QED.*[10]

This implies that the ETTP will generate the excess supply for combined Goods 1 and 2 when the budget constraints are all satisfied. Therefore, the excess demand for Good 0, the export of the rest of the world, will be increased. This suggests, under the assumption of market stability (Assumption V), that we may find the possibility of a Pareto improving PTA in the world. If the commerce between Countries 1 and 2 is encouraged by a PTA, when the export of Country 0 is a strong complement to both of Good 1 and Good 2, then a PTA between Country 1 and Country 2 will generate export boom for the rest of the world, that is, Country 0.

Except *Proposition VIII,* all the proposition in this section could be proved if there are more than two countries to join a mutually beneficial trade agreement, and if each country produces and export more than one product. The only requirement is that in compatible to the Armington assumption, all the exports are not reexported to other countries from the first port that they arrive.

6 Impossibility of a Pareto-Improving PTA in the World with Bhagwati-Ramaswami-Srinivasan Corrective Measures

It is well known that, if domestic distortions are corrected by tax-subsidy measures as proposed by Bhagwati and Ramaswami (1963) and Bhagwati, Ramaswami and Srinivasan (1969) ("BRS scheme"), the only possibly remaining distortions are in tariff managements. Therefore, in our notation,

[10] This is an application of the Farkas Theorem as well.

$$E^i du^i = S_1^i dp_1^* + S_2^i dp_2^*, \qquad i = 0, 1, 2. \tag{64}$$

Equilibrium conditions in the world market for non-numeraire commodities are

$$S_1^0 + S_1^1 + S_1^2 = 0, \tag{65}$$

$$S_2^0 + S_2^1 + S_2^1 = 0. \tag{66}$$

If the FTA benefits the member country, $(du^1, du^2) \geq 0$, which implies

$$E^0 du^0 = S_1^0 dp_1^* + S_2^0 dp_2^*$$

$$= -(S_1^1 + S_1^2) dp_1^* - (S_2^1 + S_2^2) dp_2^* = -E^1 du_1 - E^2 du_2 < 0. \tag{67}$$

Since $E^0 > 0$, $du^0 < 0$. Thus, one can state the following proposition.

Proposition IX: In a Bhagwati-Ramaswami-Srinivasan Economy where domestic distortions are corrected by tax subsidy measures, there exists no Pareto-Improving PTA without concessions to the rest of the world, regardless whether or not all the goods are normal and regardless whether goods are mutually substitutes or complements.

In this world without domestic distortion, reductions in tariffs do not contribute to the efficiency gains in the world economy.

7 Concluding Remarks

Using the expenditure-revenue function approach, this paper investigated what the economic effect would be on the welfare of the rest of the world if a PTA were formed without making concessions to the rest of the world. In the two-commodity setting, when goods are normal and none of the participants of a PTA is an entrepôt country, the formation of a PTA is unable to keep the external terms of trade or to improve the welfare of the rest of the world without tariff concessions to the rest of the world. The opposite conclusion will hold, however, if the configuration of initial tariffs or the transportation cost facilitates the member of the PTA as an entrepôt or a transient port. A formation with an entrepôt as a member always benefits the neighbors of the PTA in the two-good case. Thus, the prevalence of PTA's that involves entrepôts like Singapore and Hong Kong, may be viewed as exemplary of the fact that the total outcome of selfish economic behavior tends to choose an efficient system. This may be an example of policy development based on "what is realistic is rational."

In the three-good case, the ETTP state or the welfare improving PTA for the world without tariff concessions to the rest of the world is impossible to attain, if goods are mutually substitutes and if initial tariff levels are small.

Our results give theoretical background for interpreting the empirical findings by Winters and Chang (2000), and Chang and Winters (2002), who observe the deterioration of terms of trade to neighboring countries around PTA's. Also, these results reinforce the argument by Bagwell and Staiger (1999) that emphasizes the importance of the MFN principle as a means for keeping the welfare of the rest of the world.

From the perspective of our analysis, Article XXIV of the GATT should be interpreted much more strictly than is done at present because the welfare of the rest of the world is likely to be hurt when a PTA is formed without proper tariff concessions made to the outside countries. As far as the impact on the rest of the world is concerned, the trade diversion effect dominates the trade creation effect. Aside from the systemic "spaghetti bowl" problems accompanied by the "rules of origin," a formation of a PTA under the current interpretation of Article XXIV is a highly unfair process to nonmember countries.[11]

8 References

Bagwell, K. and R.W. Staiger (1997a), Multilateral Tariff Cooperation during the Formation of Customs Unions, *Journal of International Economics* 42(1-2): 91-123.

Bagwell, K. and R.W. Staiger (1997b), Multilateral Tariff Cooperation during the Formation of Free Trade Areas, *International Economic Review* 38(2): 291-319.

Bagwell, K. and R.W. Staiger (1999), An Economic Theory of GATT, *American Economic Review* 89(1): 215-249.

Bhagwati, J. N., R. A. Brecher and T. Hatta (1983), The Generalized Theory of Transfers and Welfare: Bilateral Transfers in a Multilateral World, *American Economic Review* 73(4), 606-618.

Bhagwati, J. N., R. A. Brecher and T. Hatta (1985), The Generalized Theory of Transfers and Walfare: Exogenous (Policy-Imposed) and Endogenous (Transfer-Induced) Distortions, *Quarterly Journal of Economics* 100(3), 697-714.

[11]It may be argued, though we do not take this view, that the benign attitude of the GATT and the WTO for neighbor trespassing PTAs will result in the further processes of mutual tariff reductions to reach a freer, if not completely free, trade regime. If Countries 1 and 2 unite to create a PTA, this may hurt neighbor countries left behind, according to our analysis. The total pie of the world will increase, however. Later Country 0 and Country 1 may as well end up in creating another PTA. According to the Hicksian Optimism (Hicks, 1941) and Corden (1984) as Hatta (1991) cited, piecemeal welfare improvements even at the cost of others may lead to the process of eventually increasing the world welfare. It will be left to the judgement of readers to decide if the present WTO regime encourages the welfare enhancement by taking a benign attitude to the temporary loss for those who are left behind.

Bhagwati, J. and V. K. Ramaswami (1963), Domestic Distortions, Tariffs, and the Theory of Optimum Subsidy, *Journal of Political Economy* 71(1), 44-50.

Bhagwati, J., V. K. Ramaswami and T. N. Srinivasan (1969), Domestic Distortions, Tariffs, and the Theory of Optimum Subsidy: Some Further Results, *Journal of Political Economy* 77(6), 1005-1010.

Bond, E. W., R. G. Riezman, and C. Syropoulos (2004), A Strategic and Welfare Theoretic Analysis of Free Trade Areas, *Journal of International Economics* 64(1), 1-27.

Chang, W. and L. A. Winters (2002), How Regional Blocs Affect Excluded Countries: The Price Effects of MERCOSUR, *American Economic Review* 92(4), 889-904.

Corden, W. M. (1984), The Normative Theory of International Trade, in R. W. Jones and P. B. Kenen (eds.), *Handbook of International Economics, Volume 1*, 63-130, New York: North-Holland.

Dixit, A. K. and V. Norman (1980), *Theory of International Trade*, Cambridge: Cambridge University Press.

Dorfman, R., P. A. Samuelson and R. M. Solow (1958), *Linear Programming and Economic Analysis*, New York: McGraw-Hill.

Endoh, M. and K. Hamada (2005), On the Conditions that Preclude the Existence of the Lerner paradox and the Metzler Paradox, *Keio Economic Studies* 42(1-2), 39-50.

Feenstra, R. C., H. Wen, W. T. Woo, and S. Yao (1999), Discrepancies in International Data: An Application to China-Hong Kong Entrepôt Trade, *American Economic Review* 89(2): 338-343.

Feenstra, R. C. and G. H. Hanson (2004), Intermediaries in Entrepôt Trade: Hong Kong Re-exports of Chinese Goods, *Journal of Economics & Management Strategy* 13(1): 3-35.

Hatta, T. (1991), Project Evaluation and Compensation Tests, in J. de Melo and A. Sapir (eds.), *Trade Theory and Economic Reform: North, South, and East - Essays in Honor of Bela Balassa*, 53-81, Cambridge, Mass.: Blackwell.

Hicks, J. R. (1941), The Rehabilitation of Consumers' Surplus, *Review of Economic Studies* 8(2), 108-116.

Kemp, M. C. and H. Y. Wan Jr. (1976), An Elementary Proposition Concerning the Formation of Customs Unions, *Journal of International Economics* 6(1), 95-98.

Mundell, R. (1964), Tariff Preferences and the Terms of Trade, *Manchester School of Economics and Social Studies* 32, 1-13.

Panagariya, A. and P. Krishna (2002), On Necessarily Welfare-Enhancing Free Trade Areas, *Journal of International Economics*, 57(2), 353-367.

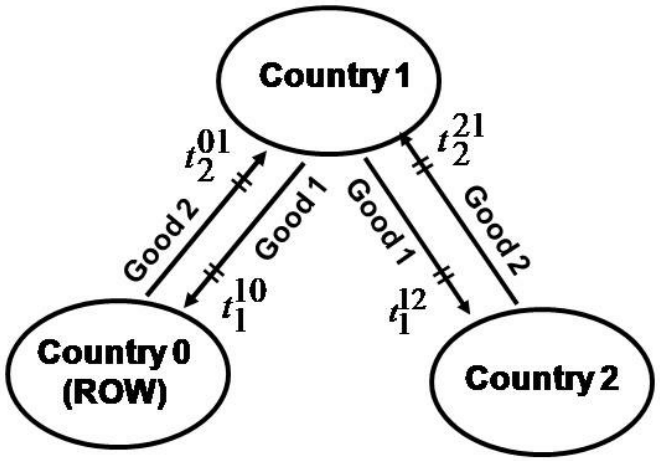
Riezman, R. and K. Shimomura (2006), Pareto-Improving Customs Unions without Income Transfers, mimeo.

Viner, J. (1950), *The Customs Union Issue*, New York: Carnegie Endowment for International Peace.

Winters, L. A. and W. Chang (2000), Regional Integration and Import Prices: An Empirical Investigation, *Journal of International Economics* 51(2), 363-377.

Woodland, A. D. (1982), *International trade and resource allocation*, Amsterdam and New York: North-Holland and Elsevier Science.

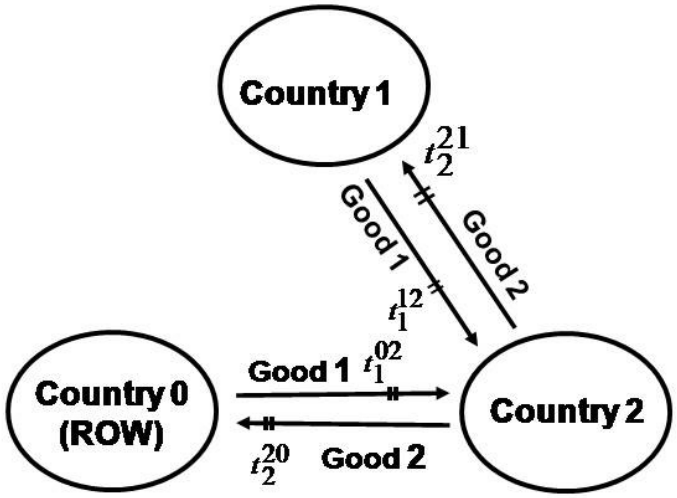
Figure 1A



Case A: Country 0 trading with Country 1 only,

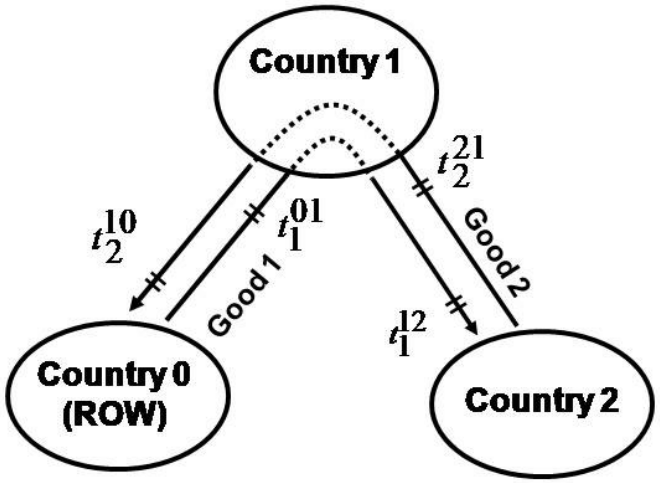
Importing Good 1 and exporting Good 2.

Figure 1B



Case B: Country 0 trading with Country 2 only,
Importing Good 2 and exporting Good 1.

Figure 1C



Case C: Country 1 is an entrepôt, passing Good 1 from Country 0 to Country 2, while passing Good 2 from Country 2 to Country 0.

Figure 2

The shift of offer curve by the formation of a PTA