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On necessarily welfare-enhancing free trade areas

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Abstract

The well-known Kemp–Vanek–Ohyama–Wan proposition establishes that if two or more countries form a customs union (CU) by freezing their net external trade vector through a *common* external tariff and eliminating internal trade barriers, the union as a whole and the rest of the world cannot be worse off than before. Owing to the fact that a Free Trade Area (whose member countries impose country specific external tariff vectors) does not equalize marginal rates of substitution across its member countries (in contrast to a CU), the literature has been unable to provide a parallel demonstration regarding welfare improving Free Trade Areas (FTAs). The present paper eliminates this gap. In extending the result to the case with intermediate inputs, the paper also sheds new light on the rules of origin required to support such necessarily welfare enhancing FTAs. We show here that provided no trade deflection is permitted, all that is required by way of rules of origin is that the goods produced within the union – whether final or intermediate – be allowed to be traded freely. The proportion of domestic value added in final goods does not enter as a criterion in the rules of origin.

Keywords: Free Trade Areas; Customs Unions; Kemp–Wan; Welfare; Rules of Origin; External Tariff

1. Introduction

The literature on preferential trade areas (PTAs), being concerned essentially

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with 'second-best' contexts,[1] rarely offers clear-cut answers with respect to the question of the welfare impact of the formation of trading blocks between nations. A singular exception is the well-known result relating to customs unions (CUs)[2], stated independently by Kemp (1964) and Vanek (1965) and proved subsequently by Ohyama (1972) and Kemp and Wan (1976), that if two or more countries freeze their net external trade vector with the rest of the world through a set of common external tariffs (CET) and eliminate the barriers to internal trade, the welfare of the union as a whole necessarily improves and that of the rest of the world does not fall.[3]

The logic behind the Kemp–Vanek–Ohyama–Wan theorem is as follows: By fixing the combined, net extra-union trade vector of member countries at its pre-union level, we can guarantee non-members their original level of welfare. Moreover, taking the extra-union trade vector as an endowment, the joint welfare of the union is maximized by equating the marginal rate of substitution and marginal rate of transformation for each pair of commodities to each other and across all agents in the union. This implies the elimination of all internal distortions. The PTA thus constructed has a common internal price vector implying further a *common* external tariff; it is therefore a Customs Union.

More than three decades have passed since the publication of the original statement of the Kemp–Vanek–Ohyama–Wan theorem. However, progress in the literature on this subject has been minimal. In particular, we still lack a parallel result on Free Trade Areas (FTAs) where members could use *member-specific* external tariff vectors rather than the common external tariff vector required by CUs. The purpose of the present paper is to fill this gap in the literature – a major gap, in our judgment, given the relative popularity of FTAs over CUs in practice.

It should be straightforward to see that a demonstration regarding welfare-improving FTAs is substantially more complex than that for CUs: In the case of an FTA, member-specific tariff vectors imply that the domestic-price vectors differ across member countries. This, in turn, implies that an FTA (as opposed to a CU) generally fails to equalize marginal rates of substitution across union members.[4] It is this difficulty which accounts for why the Kemp–Vanek–Ohyama–Wan result has not been extended to FTAs to-date.

In this paper, we demonstrate that as long as goods produced within the union move free of duty across member-country borders, a welfare-enhancing FTA can

[1] On some general results concerning policy intervention in the presence of second best distortions and a unification of such results in the international trade literature, see Krishna and Panagariya (2000).

[2] To get the basic definitions out of the way: A Customs Union (CU) is a preferential trade agreement in which member countries maintain a common external tariff vector against non-members. In contrast, in a Free Trade Area (FTA), member countries may maintain member-specific external tariff vectors. For a recent, comprehensive survey of the literature on preferential trading, see Panagariya (2000).

[3] Panagariya (1997) offers a detailed history of this result.

[4] It should be readily evident that this non-equalization of the marginal rates of substitution across agents within the FTA implies that the Kemp–Wan proof methodology cannot be directly applied here.

be constructed even if the goods prices differ across member countries. The welfare-improving FTA we propose has the property that member countries within the FTA *individually* import the same vector of quantities from the rest of the world in the post-FTA equilibrium as in the pre-FTA equilibrium. Our analysis begins in Section 2, where we explain intuitively, within a partial-equilibrium framework, why an FTA constructed in this manner must enhance joint welfare. In Section 3, we extend this to a full general-equilibrium setting and provide a formal proof. In Section 4, we show that the result is robust to the inclusion of intermediate inputs in production. Section 5 discusses in substantial detail the rules of origin necessary to support the FTA equilibrium. Section 6 concludes.

2. Partial equilibrium analysis

We consider first the simplest model capable of capturing the difference between the Kemp–Vanek–Ohyama–Wan customs union and our FTA construction. Call the potential union members Home and Foreign and the rest of the world ROW. Unless otherwise noted, lower-case letters are used to denote variables associated with Home and upper case letters those associated with Foreign. Assume that preferences are quasi-linear with the marginal utility of consumption of the numeraire good being constant. Also assume that the numeraire good uses only labor while non-numeraire goods use labor and a sector-specific factor. These assumptions effectively imply a partial-equilibrium analysis on which we rely in the present section. Since we will be holding the prices in ROW constant by freezing the quantities traded by it, we define units of goods in such a manner that the prices in ROW are all unity.

In Fig. 1a and b, we depict the demands by Home and Foreign by dd and DD, respectively, for a non-numeraire good that is not produced at home. Home levies a tariff at rate t^0 and Foreign at rate $T^0 > t^0$. Since the price in ROW is 1, the domestic price in Home settles at $1 + t^0$ and in Foreign at $1 + T^0$. Home and Foreign consume and import quantities oc^0 and OC^0, respectively.

Suppose now that Home and Foreign form a customs union, holding their *joint* imports at $oc^0 + OC^0$. This would require setting the common external tariff at rate t^{cu} $(= T^{CU})$, where $T^0 > t^{cu} > t^0$ and the joint demand by the member countries at price $1 + t^{cu}$ is $oc^1 + OC^1$ $(= oc^0 + OC^0)$. The increase in the price in Home lowers its welfare while the decrease in price in Foreign does the opposite. But since the marginal benefit of consumption is higher in Foreign in the initial equilibrium, the shift in consumption from Home to Foreign until the marginal benefits are equalized across members leads to a net gain for the union as a whole. Thus, the customs union improves the welfare of the union and does not hurt the outside world. The loss to Home is measured by trapezium *ghkv* and the gain to Foreign by *GHKV*. But since $kv = KV$ and $hk = HK$, the gain is necessarily bigger

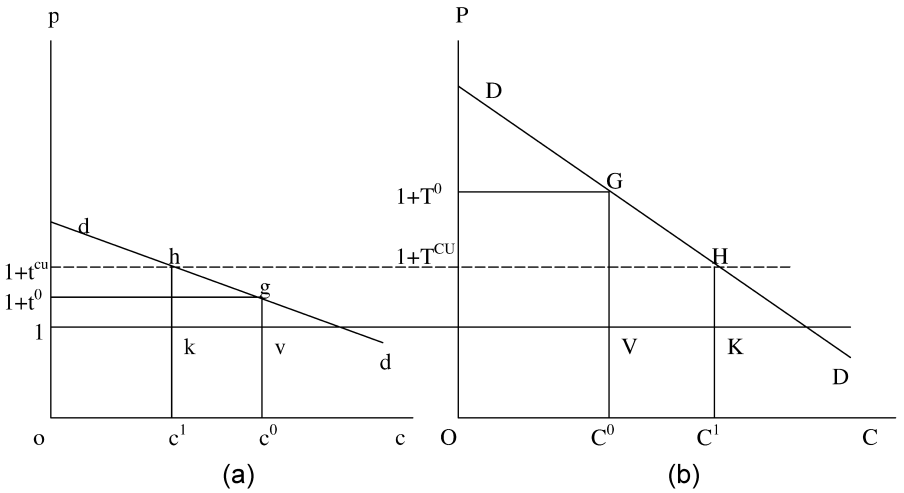

Fig. 1. CU and FTA without internal production.

than the loss. Moreover, holding the union-wide imports fixed, the union cannot improve upon this equilibrium.

Suppose, next, that Home and Foreign form an FTA rather than the customs union, each fixing the external tariff such that its imports are unchanged. Because the member countries do not produce the good, the only way to achieve this outcome is to fix the external tariffs at the same rate as initially and adopt the rule of origin whereby goods are not allowed to be trans-shipped; that is to say, goods consumed in Foreign are not permitted to be imported via Home at the lower tariff. Since there is no production of the good within the union to take advantage of duty-free movement of goods produced inside the union, under this arrangement, the outcome is the same as under the non-discriminatory tariff. The FTA neither improves nor lowers welfare.[5]

It is worth noting here that in this FTA equilibrium, prices (of the imported good) are different in the two partner countries – therefore creating the incentive to import the good through the low tariff country and simply trans-ship it to the partner country by exploiting the free access to the latter's market. To prevent this type of trans-shipment (which effectively undermines the effort to maintain different tariff rates across the two partner countries), additional rules prohibiting such trans-shipment need to be introduced. These are the so-called rules-of-origin (ROOs). We proceed for the moment by simply assuming that ROOs that effectively prevent trans-shipment of this type are in place and defer a full discussion of what form these ROOs must take until Section 5.

[5]In differentiated goods models, this is not an altogether implausible outcome.

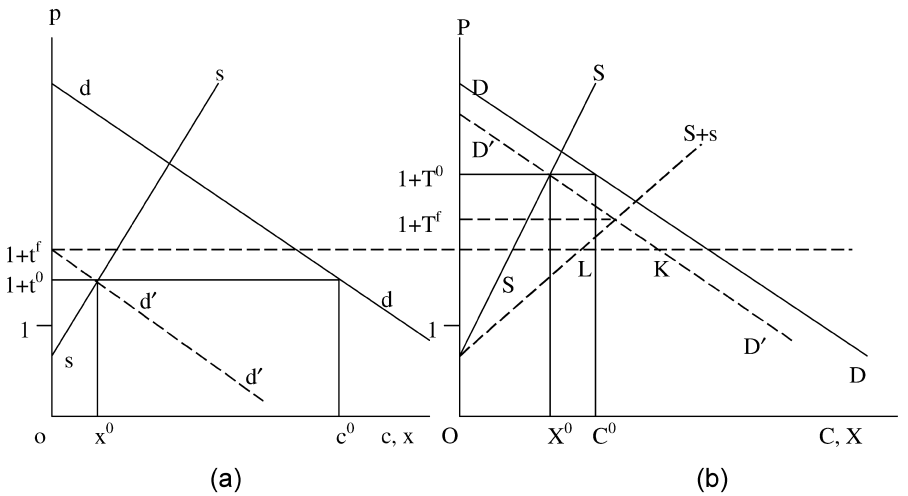

Fig. 2. CU and FTA with internal production.

Let us now modify this simple case to allow for internal production. This is done in Fig. 2a and b where ss and SS represent the supply curves in Home and Foreign, respectively. As before, initially, each country levies a non-discriminatory tariff so that internal prices are given by $1 + t^0$ in Home and $1 + T^0$ in Foreign. At $1 + t^0$, the quantities consumed, produced and imported equal ox^0, oc^0 and x^0c^0 in Home. The corresponding quantities in Foreign are OX^0, OC^0 and X^0C^0.

Suppose now that Home and Foreign form a customs union, holding their joint imports fixed at $x^0c^0 + X^0C^0$. This is accomplished by a common external tariff that lies between t^0 and T^0. Without demonstrating this in Fig. 2a and b, we note that, as before, taking the total union-wide imports as fixed, the common external tariff maximizes the joint welfare of the union by equating the marginal benefit and marginal cost of production with each other and across Home and Foreign.

Next, consider the formation of an FTA between Home and Foreign with the imports of each country fixed at their pre-FTA level. To show how this works, subtract Home's initial imports, x^0c^0, from its demand curve and obtain $d'd'$ as the residual demand that must be satisfied by within-union sources of supply. Analogously, obtain $D'D'$ by subtracting X^0C^0 from DD as the demand in Foreign that must be satisfied by within-union sources of supply.

The key point to emphasize is that if imports are subject to different tariff rates and the rules of origin forbid the low-tariff member from importing goods from outside for duty-free sales in the high-tariff country, the prices consumers pay in the two countries will differ from each other. In particular, they will be higher in the member with the higher tariff. Suppose, as will turn out to be true in our example, that the post-FTA tariff that supports the pre-FTA imports is higher in

Foreign than Home. It is then immediate that all within-union output will be sold in Foreign. Conversely, if the post-FTA tariff happens to be higher in Home, all within-union output will be sold in that country. Only if the post-union tariff happens to be the same in the two countries, implying a coincidence of the FTA and customs union solutions in the good under consideration, will the internal supply be sold in both countries.

In Fig. 2, given the post-FTA tariff and hence the higher consumer price in Foreign, no within-union output is sold in Home. This means the tariff in Home must be set at t^f such that $1 + t^f$ represents the 'reservation price.' At this price, all demand in Home is satisfied by imports while its entire supply is sold in Foreign.

In Foreign, the available internal supply is the horizontal sum of ss and SS and is shown by the dotted line denoted $s + S$. To clear the market, the internal price must be $1 + T^f$, the height of the point of intersection of $D'D'$ and $s + S$. Thus, we have T^f as the tariff in Foreign under the FTA. The reader can verify that the joint welfare of the union members, as measured by the sum of their consumers' and producers' surpluses and tariff revenues, is higher at the FTA equilibrium than at the initial equilibrium.

The outcome shown in Fig. 2 has the feature that the tariff rates that support country-specific pre-FTA imports in Home and Foreign are strictly different. This feature results from the fact that even after the entire within-union supply is diverted to Foreign, at $1 + t^f$, it falls short of the demand for within-union output. If within-union supply is sufficiently large to rule this out, ex-post, the outcome will coincide with the customs union outcome.

For example, suppose we shift ss horizontally to the right and SS horizontally to the left holding the initial tariff rates and total union-wide supply at each price constant. This will shift $d'd'$ to the right and $D'D'$ to the left. Eventually, the horizontal line from $1 + t^f$ will come to pass through the intersection of $s + S$ and $D'D'$. At this configuration of demands, supplies and initial tariffs, the FTA solution will just coincide with the customs union solution in the good under consideration. As we continue to shift ss and SS, the customs union solution will continue to obtain with the internal supply sold in both union members.

We conclude this section by noting a key point that will be important for proving our general result in the next section. For some products, the FTA solution may coincide with the customs union solution. When it does not, a single producer price nevertheless rules within the union and it equals the consumer price in the member country with the higher tariff.

3. Proof in the general case

To begin with, we consider economies with only final goods. Intermediate inputs are added to the model in the next section. The proof in this case turns out to be surprisingly simple. The maintained assumption throughout is that in the

event of differences in final prices between FTA partners on external imports, Rules of Origin (ROOs), which effectively prevent trans-shipment of these goods from low tariff countries to high tariff countries, are in place. As noted before, we defer our discussion of what form these ROOs may take until Section 5.

We continue to denote Home variables by lower case letters and Foreign variables by upper case letters. Occasionally, we need to use the price vector in the rest of the world. We denote it by an upper case letter with subscript W. A superscript 0 is used to identify the values of the variables in the initial, pre-FTA equilibrium and superscript f in the post-FTA equilibrium. If the pre- and post-FTA values of a variable happen to coincide, we use superscript 0.

Denote by $e(.)$ and $E(.)$ the standard expenditure functions and $r(.)$ and $R(.)$ the standard revenue functions in Home and Foreign, respectively. The consumer price vectors are denoted p and P and welfare levels u and U. We assume that the utility of Foreign in the post-FTA equilibrium is held fixed at its pre-FTA level through a lump sum transfer from Home. The transfer may turn out to be positive or negative. Under this assumption, weak superiority of the FTA is established provided

$$e(p^{\mathrm{f}}, u^{\mathrm{f}}) \geq e(p^{\mathrm{f}}, u^0) \tag{1}$$

Our proof involves demonstrating the validity of this inequality.

The income-expenditure inequality for the union as a whole in the post-FTA equilibrium implies

$$e(p^{\mathrm{f}}, u^{\mathrm{f}}) + E(P^{\mathrm{f}}, U^0) = r(q^{\mathrm{f}}) + (p^{\mathrm{f}} - P^0_{\mathrm{W}})m^0 + R(q^{\mathrm{f}}) + (P^{\mathrm{f}} - P^0_{\mathrm{W}})M^0, \tag{2}$$

where m^0 and M^0 are vectors of quantities imported by Home and Foreign, respectively, *from the rest of the world* (i.e. not including the imports from each other) in the post-FTA equilibrium, which are the same as in the pre-FTA equilibrium (recall that, in the post-FTA equilibrium, we are fixing each country's import vector from the rest of the world at its pre-FTA level). We note that m^0 is defined to include any goods that may have entered Home through Foreign in the pre-FTA equilibrium. That is to say, in fixing the external import vector of a member, we include in it any goods that may have been imported or exported indirectly through the partner. A similar statement applies to M^0. Vector P^0_{W} is the world price vector in the post-FTA equilibrium, which coincides with the pre-FTA equilibrium since we freeze the external trade vectors of both Home and Foreign at their pre-FTA levels. Vector q^{f} is the producer-price vector in the post-FTA equilibrium, which is the same in Home and Foreign.

By the definition of the expenditure function, we have

$$e(p^{\mathrm{f}}, u^0) \leq p^{\mathrm{f}} d^0 = p^{\mathrm{f}}[x^0 + m^0 + n^0], \tag{3a}$$

where d and x are used to represent the consumption (or demand) and output vectors, respectively. Vector n^0 represents net imports by Home from Foreign. This

vector is defined to include the quantities originating in Foreign only. As stated earlier, any goods imported by Foreign from the rest of the world and re-exported to Home are included in m^0.

Analogous to Eq. (3a), we have for Foreign,

$$E(P^f, U^0) \leq P^f D^0 = P^f[X^0 + M^0 + N^0] \tag{3b}$$

By definition, we have $n^0 = -N^0$. Subtracting the sum of Eqs. (3a) and (3b) from Eq. (2), we obtain

$$e(p^f, u^f) - e(p^f, u^0) \geq [r(q^f) + R(q^f)] - [p^f x^0 + P^f X^0] - P_W^0(m^0 + M^0) - [p^f n^0 + P^f N^0] \tag{4}$$

By the trade balance condition of the rest of the world, we can set $P_W^0(m^0 + M^0) = 0$. In addition, we have $N^0 = -n^0$. Therefore, we can rewrite Eq. (4) as

$$e(p^f, u^f) - (p^f, u^0) \geq [r(q^f) + R(q^f)] - [p^f x^0 + P^f X^0] - [p^f - P^f]n^0 \tag{5}$$

Inequality (1) is validated if the right-hand side of this inequality is non-negative. By definition of the revenue function, we know that

$$[r(q^f) + R(q^f)] \geq [p^f x^0 + q^f X^0] \tag{6}$$

Therefore, the right-hand side of Eq. (5) is non-negative if

$$[q^f x^0 + q^f X^0] \geq [p^f x^0 + P^f X^0] + [p^f - P^f]n^0 \tag{7}$$

The last step in the proof is to relate the consumer prices to producer prices. Based on the analysis in the previous section, we can divide the goods into three sets to be denoted A, B and C. In set A, we place goods for which the consumer price in Home exceeds that in Foreign. For these goods, all within-union output is sold in Home so that the union-wide producer price coincides with the consumer price in Home. In set B, we include goods for which the consumer price in Foreign exceeds that in Home. In this case, the union-wide producer price coincides with the consumer price in Foreign. Finally, in set C, we have goods for which consumer and producer prices coincide union-wide. Stated formally, we have

$$\begin{aligned} &q_A^f = p_A^f \text{ with } p_A^f - P_A^f > 0; \\ &q_B^f = P_B^f \text{ with } P_B^f - p_B^f > 0; \text{ and} \\ &q_C^f = p_C^f = P_C^f. \end{aligned} \tag{8}$$

Making use of these relationships, we can rewrite inequality (7) as

$$p_A^f X_A^0 + P_B^f x_B^0 \geq P_A^f X_A^0 + p_B^f x_B^0 + (p_A^f - P_A^f)n^0 + (p_B^f - P_B^f)n^0 \tag{7'}$$

In turn, recalling that $n^0 = -N^0$, this can be written as

$$\left(p_{\mathrm{A}}^{\mathrm{f}} - P_{\mathrm{A}}^{\mathrm{f}}\right)\left(X_{\mathrm{A}}^{0} + N_{\mathrm{A}}^{0}\right) + \left(P_{\mathrm{B}}^{\mathrm{f}} - p_{\mathrm{B}}^{\mathrm{f}}\right)\left(x_{\mathrm{B}}^{0} + n_{\mathrm{B}}^{0}\right) \geq 0. \qquad (7'')$$

Given Eq. (8) and the fact that domestic output must necessarily be at least as large as the exports to the union partner (recall that since m^0 and M^0 are defined to include *all* imports from and exports to the outside world including those channeled through the partner, n^0 and N^0 cannot include the goods imported from or exported to the outside world), this inequality is necessarily satisfied. Thus, we have established inequality (1) and hence the main result of the paper.

4. Extension to intermediate inputs

The proof above is extended readily to incorporate intermediate inputs. We note here the first few steps – these should be sufficient to see how the extension works. Since intermediate inputs do not enter the utility function and, hence, the expenditure function, holding the utility of Foreign fixed through a lump sum transfer at the pre-FTA level, Condition (1) continues to be necessary and sufficient for the FTA to weakly improve the joint welfare of the union.

The main new issue that the presence of intermediate inputs raises is that of the rules of origin. We impose here the same rules of origin as in the previous section: both the final and intermediate inputs can move free of duty within the union provided they are produced internally. In the case of final goods, it does not matter whether the inputs used in them are imported or produced internally. As we detail in Section 5, irrespective of the proportion of internal value added, they must receive duty-free treatment if the final stage of production takes place within the union.

The buyers as well as sellers of intermediate inputs are firms. For reasons similar to those in the previous section, buyer prices can differ between the union members while the seller or producer price is the same. We now use a subscript I to distinguish inputs from outputs. Thus, we denote by p_{I} the vector of buyer prices and q_{I} the vector of seller prices of inputs in Home. We can then write the revenue function, representing the maximized value of output of final and intermediate inputs, net of inputs used up, as $r(q, p_{\mathrm{I}}, q_{\mathrm{I}})$. The partial derivatives of $r(.)$ with respect to buyer prices of inputs, p_{I}, give the negative of the demand for inputs and those with respect to seller prices, q_{I}, give the supplies of the inputs in Home. As before, partial derivatives of $r(.)$ with respect to q give the outputs of final goods. Analogous notation applies to Foreign with upper case letters replacing the lower case letters everywhere but subscript I remaining unchanged. We can now replace Eq. (2) by

$$\begin{aligned} e\left(p^{\mathrm{f}}, u^{\mathrm{f}}\right) + E\left(P^{\mathrm{f}}, U^{0}\right) = {} & r\left(q^{\mathrm{f}}, p_{\mathrm{I}}^{\mathrm{f}}, q_{\mathrm{I}}^{\mathrm{f}}\right) + \left(p^{\mathrm{f}} - P_{\mathrm{W}}^{0}\right)m^{0} + \left(p_{\mathrm{I}}^{\mathrm{f}} - P_{\mathrm{IW}}^{0}\right)m_{\mathrm{I}}^{0} \\ & + R\left(q^{\mathrm{f}}, P_{\mathrm{I}}^{\mathrm{f}}, q_{\mathrm{I}}^{\mathrm{f}}\right) + \left(P^{\mathrm{f}} - P_{\mathrm{W}}^{0}\right)M^{0} + \left(P_{\mathrm{I}}^{\mathrm{f}} - P_{\mathrm{IW}}^{0}\right)M_{\mathrm{I}}^{0}, \end{aligned} \qquad (9)$$

where P^0_{IW} denotes the vector of input prices in the rest of the world and m^0_I and M^0_I the vectors of inputs imported by Home and Foreign, respectively, from it.

Inequalities (3a) and (3b) are unchanged. Therefore, remembering that the balance of trade condition of the rest of the world is now represented by $P^0_W(m^0 + M^0) + P^0_{IW}(m^0_I + M^0_I) = 0$, inequality (5) is replaced by

$$e(p^f, u^f) - e(p^f, u^0) \geq [r(q^f, p^f_I, q^f_I) + R(q^f, p^f_I, q^f_I)] - [p^f x^0 + P^f X^0] - [p^f - P^f]n^0 + [p^f_I m^0_I + P^f_I M^0_I] \quad (10)$$

Next, the revenue function for Home is $r(q, p_I, q_I) = \max\{q.x + q_I.x_I - p_I.d_I\}$, where x_I is the output vector and d_I the demand vector of inputs in Home. An analogous relationship holds for Foreign. Therefore, inequality (6) is replaced by

$$[r(q^f, p^f_I, q^f_I) + R(q^f, p^f_I, q^f_I)] \geq [q^f x^0 + q^f X^0] + [q^f_I x^0_I + q^f_I X^0_I] - [p^f_I d^0_I + P^f_I D^0_I] \quad (11)$$

From Eq. (11), inequality (10) is satisfied provided we have

$$[q^f x^0 + q^f X^0] + [q^f_I x^0_I + q^f_I X^0_I] - [p^f_I d^0_I + P^f_I D^0_I] \geq [p^f x^0 + P^f X^0] + [p^f - P^f]n^0 - [p^f_I m^0_I + P^f_I M^0_I] \quad (12)$$

We know that the total input demand in Home must be satisfied by domestic output, imports from the partner or imports from the rest of the world. That is to say, $d^0_I = x^0_I + n^0_I + m^0_I$, where n^0_I is the vector of inputs imported by Home from Foreign. Analogously, $D^0_I = X^0_I + N^0_I + M^0_I$ for Foreign. Making use of these relationships and $N^0_I = -n^0_I$, we can rewrite Eq. (12) as

$$[q^f x^0 + q^f X^0] + [q^f_I x^0_I + q^f_I X^0_I] \geq [p^f x^0 + P^f X^0] + [p^f_I x^0_I + P^f_I X^0_I] + [p^f - P^f]n^0 + [p^f_I - P^f_I]n^0_I \quad (12')$$

This inequality tracks inequality (7′) identically, taking into account the fact that we now have intermediate inputs. The remainder of the proof is straightforward in view of the proof in the previous section.

5. Rules of origin necessary to prevent trans-shipment

In proving the existence of welfare improving FTAs, we have assumed so far that we use rules of origin to prevent trans-shipment of imports. This implies that goods imported by the low-tariff member are not permitted to cross over to the high-tariff member country duty-free unless they have undergone some trans-formation. Thus, duty-free access necessarily applies to goods produced wholly within the union. Additionally, goods containing foreign intermediate components are given duty-free status provided the intermediates have undergone some

transformation. Imported goods, whether intermediate or final, may not be trans-shipped in their original form.

In of itself, this requirement may be seen as being somewhat incomplete for the following reason. In the FTA equilibrium that obtains, consumer prices differ across member countries (else, the FTA is in fact just a CU). Given the differing consumer prices across countries, agents have the incentive to import a given product through the low-tariff country, repackage and, thus, transform it into a trivially different good, and avail themselves of the duty free status in the higher-tariff partner country. This unrestrained trans-shipment would render the FTA arbitrarily close to a CU.

To avoid this possibility, we need to elaborate on the rule of origin necessary to support the FTA keeping in mind that the proposed rule should not interfere with the equilibrium outcomes [and indeed conditions (6), (7), (11) and (12)] for welfare improvement described in Sections 3 and 4. We first describe the precise rule of origin required within our theoretical model and then discuss its practical counterpart.

Rule of origin: A good wholly produced within the union is given duty free access to all countries within the union. Alternatively, if the good contains imported intermediates, it is allowed duty free access provided it differs from any of the intermediates it contains ***and*** is a good that existed prior to the formation of the FTA. Thus, we require additionally that any new good (i.e. goods not existing in the pre-FTA equilibrium) be given duty free access to union countries only if it is wholly produced within the union.

To explain how this rule works (without interfering with the welfare improving equilibrium outcome described in our proof) suppose there are 100 final and intermediate products in the pre-FTA equilibrium, which are denoted 1, 2 . . . 100. Now consider a product crossing the intra-union border. The importer must first declare whether the product corresponds to one of these 100 products. If yes, he identifies the precise classification number of the product, say, 80. He must then identify the classification numbers of components imported from outside the union. If these are all different from 80, the product enters duty free. If one or more of them coincide with 80, duty-free status is not given.

Observe that the importer no longer has an incentive to bring product 80, repackage it and claim it as a *different* product. If he were to do that, he will have to declare it as a *new* product that is different from product 80. This will automatically result in the denial of the duty-free status. Of course, if he were to declare the product as 80, the imported components would coincide with the product and the importer would fail to satisfy the transformation rule.

Thus our rule ensures that there is no trans-shipment of imports from the low-tariff member to the high-tariff member without imposing any *new constraints* on the problem. It is important to note that the rule prohibiting the trans-shipment of products (product 80 in the above example) does not imply a more restrictive environment than in the pre-FTA equilibrium. Any trans-shipment that existed in

the pre-FTA equilibrium continue to reach the country of its final destination; only that they now come directly to that country since the external trade vector of each member includes not only the imports it received directly from the rest of the world but also those it receives through the partner in the form of trans-shipments [see the discussion following Eq. (2) above]. Therefore, our rule of origin fully preserves our proof.

We have thus shown that theoretically there exists a rule of origin capable of supporting the FTA equilibrium we have identified. We can now ask how this rule can be applied in practice. For most products, our *transformation* rule can be applied using the harmonized system of classification. Duty-free status is necessarily given to a product that is produced wholly within the union or belongs to a classification category different from all components imported from extra-union trading partners. The harmonized system of classification, which is used by virtually all countries, disaggregates products up to the ten-digit level. In most cases, this level of disaggregation suffices to distinguish products that satisfy our theoretical rule from those that have been simply repackaged and do not satisfy it.[6] For example, an automobile imported from an outside country and simply repackaged will fail this test since it will fail to move from one classification category to another.

We note that that the transformation requirement we have stated above and its implementation is entirely consistent with the rules of origin implemented in actual practice – in NAFTA, for instance. In Appendix A, we reproduce a description of the NAFTA rules of origin from LaNasa (1993). It should be readily evident that the first three rules described there match very closely our transformation rule. It may be interesting to note further that to rule out trivial transformations of the type we have considered earlier in this section, the NAFTA rules of origin explicitly state that 'mere dilution with water or another substance that do not materially alter the characteristics of the product do not count as a transformation.'

[6]While the transformation rule we have described satisfies our theoretical requirements completely, in practice, there remain a small fraction of products that may have undergone transformation according to our theoretical criterion but are classified in the same category as its components. For example, the harmonized system places a finished bicycle and its completely knocked down (CKD) kit under the same tariff heading. If a union member produces a bicycle by assembling a CKD kit imported from an extra-union partner, our theoretical criterion is satisfied but the implementation rule fails to identify it as an item qualified for duty-free access. To rule out this possibility, we need an addition valued-added rule to be calculated as follows. Compute the FTA equilibrium we have outlined in Section 3 or 4 as the case may be. The computed equilibrium values of various variables allow us to calculate the ex-post value added necessary to convert the CKD kit into a finished bicycle. We set the valued-added requirement for duty-free entry for finished bicycle equal to this value added. Since this valued added has been computed at the equilibrium that satisfies conditions (6) and (7) or their equivalent, (11) and (12) in Section 4, adding the valued added rule of origin has no impact on the outcome while it ensures that the CKD kit is not trans-shipped. The fourth NAFTA rule of origin in Appendix A provides the real world parallel to this criterion, though we hasten to add that since the actual value added requirement there is ad hoc, the resulting FTA is different from the one we have computed here.

6. Concluding remarks

As emphasized in Bhagwati and Panagariya (1996a,b) and Bhagwati et al. (1997), we conclude this paper by noting that these results are existence results and should not be taken to imply that any particular FTA is welfare improving. Indeed, as we have already noted, both Kemp–Vanek–Ohyama–Wan and the present results require a particular structure of external tariffs to guarantee an improvement in welfare relative to the initial equilibrium. Finally, though our result implies that there exists an FTA path to complete multilateral free trade along which global welfare rises monotonically, it does not and cannot imply that such a path will actually be adopted. The latter question requires a political-economy theoretic, incentive-structure analysis and raises a different set of problems as analyzed in the recent contributions of Krishna (1998) and Levy (1997).

An interesting implication of our analysis relates to rules of origin, which did not form a part of the Kemp–Vanek–Ohyama–Wan analysis for the reason that they only dealt with the customs union problem. We have shown here that provided no trade deflection is permitted[7], all that is required by way of rules of origin is that the goods produced within the union – whether final or intermediate – be allowed to be traded freely. The proportion of domestic value added in final goods does not enter as a criterion in the rules of origin.

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Appendix A. NAFTA rules of origin

In this appendix, we draw on LaNasa (1993) to offer a brief description of the NAFTA rules of origin. A product qualifies for preferential treatment under NAFTA, if it passes one of the following five tests:

(i) The product is wholly obtained or produced in the territory of one or more of the member countries.

[7]By no trade deflection, we mean that in the post-FTA equilibrium, extra-union imports pay the tariff rate of the country of final destination. They should not be permitted to enter the union through the border of a member with a lower tariff and then shipped freely to another member with higher tariff.

(ii) The product is produced entirely in the territory of one or more of the Parties exclusively from originating materials.

(iii) If a product contains any materials not originating in North America, **it is classified as a North American good if each non-originating material undergoes a change in tariff classification caused by production that occurs entirely within Canada, Mexico, or the United States.** NAFTA defines the required change by reference to changes in the HTS. The HTS is an international standard that harmonizes tariff nomenclature worldwide. It classifies products according to a hierarchical framework that reflects increasing degrees of technical sophistication and economic effort). The type and degree of change required depends upon the type of product.

(iv) If a non-originating part does not qualify under the change in tariff classification test because the tariff heading for it and the product crossing the border is the same, the product can still be treated as originating in North America if it meets the required regional value content test.

(v) If a good fails all of the above tests, the product will be classified as North American if the non-originating material is de minimis, that is, less than 7% of the transaction value (price) or total cost of the good.

There are three cases in which a good that qualifies for North American origin can be disqualified from preferential treatment. First, the good is disqualified if after qualifying, it undergoes further processing outside North America. Second, **mere dilution with water or another substance that does not materially alter the characteristics of the product does not count as a qualifying operation**. Finally, any good undergoing any process, work or pricing practice aimed at circumventing NAFTA's rules of origin is disqualified from preferential treatment.

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