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This paper contains preliminary findings from research work still in progress and should not be quoted without prior approval of the author.

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1. INTRODUCTION

Much of the early analysis of preferential trading clubs (a general term, including free-trade areas and customs unions) was couched in terms of models with three countries (the two partner countries and the rest of the world) and two goods. These 3 X 2 models suffer from the drawback that, generally, it is not possible for both members of the club to trade contemporaneously with both their partner and the rest of the world. The trade pattern is asymmetric and formation of the club typically involves a complete reorientation in the pattern of world trade. In the light of this there has recently been a growth in the literature on models with three commodities. The earliest discussion of such a model was by Meade (1955, Ch. III) which was expanded upon by Mundell (1964), Vanek (1965, appendix), Lipsey (1970, Chs. 5 and 6) and McMillan and McCann (1981). In addition, Corden (1976), Berglas (1979), Collier (1979), and Riezman (1979) have analyzed preferential trading agreements in 3-commodity models. This activity has resulted in a multitude of seemingly unrelated results which have, fortunately, been resolved and integrated by Lloyd (1982).

It may be asked, however, whether the discussion of preferential trading agreements should be moved to yet higher dimensions. A 3 X 3 model permits analysis of a symmetrical trading pattern but does not allow all possible patterns of trade in goods, symmetrical or otherwise, to be analyzed. Lloyd (p. 50) illustrated six possible patterns while Collier claims that a model with at least five commodities would be necessary for all possible patterns to be present simultaneously. An increase in dimensionality can easily result in intractability. Both Berglas and McMillan and McCann

discuss the extension of their analyses to higher dimensions of commodities but the latter authors do this by increasing the number of goods with no change in the trade pattern.

The purpose of this paper is to present a 3 X n model of international trade that both encompasses, subject to some restrictions noted below, any trading pattern whatsoever and is easily tractable. In addition, the constraint of specialization in production, made initially by Meade, is relaxed, all countries being able to produce all goods. A full spectrum of trade taxes, rather than only import tariffs, can also be discussed. Two strong assumptions are made (which are shared by Berglas, Meade, Riezman, and others, but not by Corden) that: firstly, all countries trade and consume all goods; and, secondly, the formation of a preferential trading club may change the volume, but not the existing pattern of international trade.[1]

The remainder of the paper is as follows. In part 2, the general structure of the model, using the dual approach to international trade of Dixit and Norman (1980), is introduced. The formation of a preferential trading club by members reducing their duties on trade with partners, is discussed in section 3. Section 4 examines the benefits of making preferential trading agreements between small countries while the large countries' effects are analyzed in section 5. The paper ends with a summary and conclusions.

2. THE GENERAL MODEL

There are three countries in the world, A, B, and C, each consisting of a single consumer. Each country has an arbitrary number of factors of production, all in fixed supply. There are n commodities produced in the world economy and all are consumed in each country. Each country either exports a particular good to or imports it from one or both of the other countries.

In addition, it is assumed that there is no "cross-hauling", that is, no country exports a particular good to one country and imports the same good from the other. Given these assumptions, six patterns of trade in any particular good are possible--in each case one of the countries trades with the two others, either exporting the good to both or importing it from both. The trade patterns are represented as: B-A-C; A-B-C; and A-C-B--where the centre country trades with the other two. Distinction between export goods and import goods will be made where necessary.

In the initial trading equilibrium, each country has imposed a tax-cum-subsidy structure on its international trade. An import tariff on a good raises its domestic price above the international price while a tax on an export lowers that good's domestic price relative to its international price. The equilibrium may be represented as:

$$e^a(p^a,u^a) = r^a(p^a,v^a) + t^a \cdot m^a \qquad (1)$$

$$e^b(p^b,u^b) = r^b(p^b,v^b) + t^b \cdot m^b \qquad (2)$$

$$e^c(p^c,u^c) = r^c(p^c,v^c) + t^c \cdot m^c \qquad (3)$$

where $e^j(p^j,u^j)$ is the minimum expenditure necessary by country J to achieve

utility u^j when the vector of domestic prices of n goods is p^j; $r^j(p^j,v^j)$ is the maximum attainable revenue at the same domestic prices, given the fixed vector of factor supplies, v^j; and $t^j \cdot m^j$ is the total of tax revenues on international trade, t^j being the vector of specific import tariffs (positive terms) and export taxes (negative terms) and m^j being the vector of net imports of the n goods. Output supply and consumption demand for goods are obtained by differentiating with respect to price the revenue function and the expenditure function respectively. Import demand for a particular good is the difference between its domestic demand and domestic supply:

$$m^j = e^j_p - r^j_p \quad \text{for } j = a,b,c. \tag{4}$$

In equilibrium, international excess demand for each good must be zero:

$$e^a_p + e^b_p + e^c_p - r^a_p - r^b_p - r^c_p = 0. \tag{5}$$

That is,

$$m^a + m^b + m^c = 0.$$

The domestic price of each good is distorted from the international price, p^e, by the amount of the trade tax

$$p^j = p^e + t^j \quad \text{for} \quad j = a,b,c.$$

3. PREFERENTIAL TRADING CLUB

Let countries A and B form a preferential trading club (PTC) by marginally lowering duties on bilateral trade, such that the pattern of trade is not disturbed. If such taxes were entirely eliminated A and B would constitute a Free Trade Area (FTA). If their taxes on trade with C

were also to be equalized this would result in a Customs Union (CU).[2] Some discrimination must now be made between a country's sources of imports and between the destinations of its exports, as the tax revenues will be lower for trade with its partner. The national income-expenditure relations become

$$e^a(p^a,u^a) = r^a(p^a,v^a) + t^{ai} \cdot m^{ab} + t^{ae} \cdot m^{ac} \qquad (6)$$

$$e^b(p^b,u^b) = r^b(p^b,v^b) + t^{bi} \cdot m^{ba} + t^{be} \cdot m^{ac} \qquad (7)$$

$$e^c(p^c,u^c) = r^c(p^c,v^c) + t^c \cdot m^c \qquad (8)$$

where the superscripted i and e refer to intra-club and extra-club respectively and m^{jk} is the net imports of country J from country K. Thus

$$m^{ab} + m^{ac} = m^a$$

$$m^{ba} + m^{bc} = m^b$$

Note that $m^{ab} = - m^{ba}$ (9)

and thus $m^{ac} + m^{bc} = -m^c$.

Countries trading with one another must do so at the same international terms of trade. Thus if good X is traded between A and B, in the club, then

$$p_x^a - t_x^{ai} = p_x^b - t_x^{bi} = p_x^i$$

where p_x^i is the intra-club price of good X. Cross-hauling of goods does not occur and so only one of A and B trades with C when there is also intra-club trade.

$$p_x^j - t_x^{je} = p_x^c - t^c = p_x^e \quad \text{for} \quad j = \text{either a or b.}$$

If, before the formation of the club, A and B do not trade with one another in a particular good, then a marginal reduction of impediments to

trade between them will have no effect.[3] The preferential trading club is therefore formed by the reduction of trade taxes on goods, X, for which $m_x^{ab} \neq 0$.

Total differentiation of the equilibrium conditions (5, 6, 7, and 8) results in:

$$e_p^a \cdot dp^a + e_u^a du^a = r_p^a \cdot dp^a + t^{ai} \cdot dm^{ab} + t^{ae} \cdot dm^{ac} + m^{ab} \cdot dt^{ai}$$

$$e_p^b \cdot dp^b + e_u^b du^b = r_p^b \cdot dp^b + t^{bi} \cdot dm^{ba} + t^{be} \cdot dm^{bc} + m^{ba} \cdot dt^{bi}$$

$$e_p^c \cdot dp^c + e_u^c du^c = r_p^c \cdot dp^c + t^c \cdot dm^c$$

$$e_{pp}^a dp^a + e_{pu}^a du^a + e_{pp}^b dp^b + e_{pu}^b du^b + e_{pp}^c dp^c + e_{pu}^c du^c$$
$$- r_{pp}^a dp^a - r_{pp}^b dp^b - r_{pp}^c dp^c = 0.$$

Let $s^j = e_{pp}^j - r_{pp}^j$, for $j = a,b,c$, the matrices of derivatives of the countries' compensated excess demands for goods with respect to prices. The world matrix is $S = s^a + s^b + s^c$. These matrices are negative semi-definite. With the assumption that expenditure and revenue functions are linearly homogeneous,

$$s^j p^j = 0, \text{ for } j = a,b,c. \tag{10}$$

Substituting these and equation (4) yields

$$\left.\begin{aligned} m^a \cdot dp^a + e_u^a du^a &= t^{ai} \cdot dm^{ab} + t^{ae} \cdot dm^{ac} + m^{ab} \cdot dt^{ai} \\ m^b \cdot dp^b + e_u^b du^b &= t^{bi} \cdot dm^{ba} + t^{be} \cdot dm^{bc} + m^{ba} \cdot dt^{bi} \\ m^c \cdot dp^c + e_u^c du^c &= t^c \cdot dm^c \end{aligned}\right\} \tag{11}$$

$$s^a dp^a + s^b dp^b + s^c dp^c + e_{pu}^a du^a + e_{pu}^b du^b + e_{pu}^c du^c = 0 \tag{12}$$

How are domestic price changes related to one another? This depends on the pattern of trade for each good. Suppose good X is traded according

to pattern B-A-C. In this case, A's domestic price of those X produced in or exported to B must be equal to A's domestic price of those X traded with C. That is

$$p_x^a = p_x^e + t_x^{ae} = p_x^i + t_x^{ai}$$

Now $p_x^c = p_x^e + t_x^c$ and $p_x^b = p_x^i + t_x^{bi}$.

Differentiating, setting $dt_x^{ae} = 0$,

$$dp_x^a = dp_x^e = dp_x^i + dt_x^{ai}$$

$$dp_x^c = dp_x^e$$

$$dp_x^b = dp_x^i + dt_x^{bi}.$$

Thus $dp_x^a = dp_x^c = dp_x^b + \Delta_x = dp_x^e$

where $\Delta_x = dt_x^{ai} - dt_x^{bi}$.

Similarly, for trade pattern A-B-C,

$$dp_x^b = dp_x^c = dp_x^a - \Delta_x = dp_x^e.$$

This may be summarized for all goods as

$$dp^a = dp^e + \Delta^a \tag{13}$$

$$dp^b = dp^e - \Delta^b \tag{14}$$

where $\Delta_x^a = \begin{cases} \Delta_x, & \text{for trade pattern A-B-C} \\ 0, & \text{otherwise} \end{cases}$

$$\Delta_x^b = \begin{cases} \Delta_x, & \text{for trade pattern B-A-C} \\ 0, & \text{otherwise} \end{cases}$$

$$\Delta^a + \Delta^b = \Delta = dt^{ai} - dt^{bi} .$$

Whenever A or B trades with C, the change in the domestic price of that good is tied to the change in the extra-club price. Thus

$$m^{ac} \cdot dp^a = m^{ac} \cdot dp^e$$

$$m^{bc} \cdot dp^b = m^{bc} \cdot dp^e$$

However, $m^{ab} \cdot dp^a = m^{ab} \cdot (dp^e + \Delta^a)$

$$m^{ba} \cdot dp^b = m^{ba} \cdot (dp^e - \Delta^b).$$

Rewriting (11),

$$m^a \cdot dp^e + m^{ab} \cdot \Delta^a + e^a_u du^a = t^{ai} \cdot dm^{ab} + t^{ae} \cdot dm^{ac} + m^{ab} \cdot dt^{ai}$$

$$m^b \cdot dp^e - m^{ba} \cdot \Delta^b + e^b_u du^b = t^{bi} \cdot dm^{ba} + t^{be} \cdot dm^{bc} + m^{ba} \cdot dt^{bi}$$

$$m^c \cdot dp^e + e^c_u du^c = t^c \cdot dm^c$$

Let $dT = dt^{ai} - \Delta^a = dt^{bi} + \Delta^b$

where

$$dT_x = \begin{cases} dt^{bi}_x, & \text{for trade pattern A-B-C} \\ dt^{ai}_x, & \text{for trade pattern B-A-C} \\ 0, & \text{for trade pattern A-C-B} \end{cases}$$

dT measures the shift of intra-club prices from extra-club prices,

$$dT = dp^e - dp^i.$$

Substitute this, together with the initial non-discriminatory tariffs,

$$t^{ai} = t^{ae} = t^a$$

and $$t^{bi} = t^{be} = t^b,$$

to obtain

$$\left.\begin{aligned} m^a \cdot dp^e + e^a_u du^a &= t^a \cdot dm^a + m^{ab} \cdot dT \\ m^b \cdot dp^e + e^b_u du^b &= t^b \cdot dm^b + m^{ba} \cdot dT \\ m^c \cdot dp^e + e^c_u du^c &= t^c \cdot dm^c \end{aligned}\right\} \qquad (15)$$

Summing across this equation yields

$$e^a_u du^a + e^b_u du^b + e^c_u du^c = t^a \cdot dm^a + t^b \cdot dm^b + t^c \cdot dm^c,$$

world welfare depends solely on the volume of trade.

Recalling equation (4) and differentiating

$$dm^j = e^j_{pp} dp^j - r^j_{pp} dp^j + e^j_{pu} du^j, \quad \text{for } j = a,b,c.$$

Rewriting, letting $e^j_{pu} = c^j_y e^j_u$, then

$$dm^j = s^j dp^j + c^j_y e^j_u du^j$$

Substituting this, and equations (13) and (14), into (12) and (15):

$$\left.\begin{aligned} (m^{a'} - t^{a'} s^a) dp^e + (1 - t^a \cdot c^a_y) e^a_u du^a &= t^{a'} s^a \Delta^a + m^{ab} \cdot dT \\ (m^{b'} - t^{b'} s^b) dp^e + (1 - t^b \cdot c^b_y) e^b_u du^b &= -t^{b'} s^b \Delta^b + m^{ba} \cdot dT \\ (m^{c'} - t^{c'} s^c) dp^e + (1 - t^c \cdot c^c_y) e^c_u du^c &= 0 \end{aligned}\right\} \qquad (16)$$

$$S dp^e + c^a_y e^a_u du^a + c^b_y e^b_u du^b + c^c_y e^c_u du^c = s^b \Delta^b - s^a \Delta^a \qquad (17)$$

4. A AND B AS "SMALL" COUNTRIES

Suppose the economy of country C is sufficiently large relative to those of A and B that changes in intra-club tariffs would have no effect on either the domestic prices of C or the extra-club international prices, i.e. $dp^e = 0$. In such a case, the relations of (16) reduce to

$$\left.\begin{aligned}(1 - t^a \cdot c_y^a) e_u^a du^a &= t^{a'} s^a \Delta^a + m^{ab} \cdot dT \\ (1 - t^b \cdot c_y^b) e_u^b du^b &= -t^{b'} s^b \Delta^b + m^{ba} \cdot dT \\ (1 - t^c \cdot c_y^c) e_u^c du^c &= 0\end{aligned}\right\} \qquad (18)$$

The welfare of country C is unaffected by intra-club behavior. Rewriting,

$$\left.\begin{aligned}du^a &= \frac{1}{(1 - t^a \cdot c_y^a) e_u^a} \{t^{a'} s^a \Delta^a + m^{ab} \cdot dT\} \\ du^b &= \frac{1}{(1 - t^b \cdot c_y^b) e_u^b} \{-t^{b'} s^b \Delta^b + m^{ba} \cdot dT\}\end{aligned}\right\} \qquad (19)$$

Consider the welfare impact on country A of the formation of a preferential trading club. Changes in intra-club tariffs will have different consequences dependent on the pattern of trade.

Let the trade pattern for good X be B-A-C. Then $\Delta_x^a = 0$. Country A continues to trade in X with country C, but neither has there been a change in extra-union prices nor has A changed its extra-union taxes. Thus A's domestic price for X is unaltered. A has, however, lowered its barriers on trade in X with B, offering it improved terms of trade. A has therefore "diverted"[4] its trading in X from C to B, the higher-price supplier (or, in the case of exports of X from A, the lower-price buyer). No benefit comes to A from an improvement in its terms of trade, yet it suffers the loss of tariff revenues, $m_x^{ab} dt^{ai}$.

Let the pattern of trade in good X be A-B-C instead. B now has its domestic prices fixed and so its reduction in the intra-club taxes will

improve A's terms of trade, as will A's own tax reduction. For example, if X is imported by A, then $dt_x^{ai} < 0$, $dt_x^{bi} > 0$ (A lowers its tariff, B lowers its export tax) and so $\Delta_x^a = dt_x^{ai} - dt_x^{bi} < 0$. Whether A benefits from this depends on the sign of $t^{a'} s^a \Delta_x^a$. The total effect on the welfare of A through changes in the terms of trade as a result of a preferential trading agreement depends on $t^{a'} s^a \Delta^a$. This is discussed in the appendix, the condition for welfare improvement from the change in A's terms of trade for these goods being

(i) the imported goods must be substitutes for A's exports;

(ii) the exported goods must be substitutes for A's imports.

These conditions are closely related to, but more general than, those derived by McMillan and McCann. With output being fixed in their model, substitutability in consumption was necessary for welfare improvement. When production is variable, it may be a source of substitution that compensates for any complementarity in consumption.

A will additionally benefit by $m_x^{ab} dt_x^{bi}$ from being paid a higher price for existing trade between the two countries. Note that this gain is exactly equal to the loss in tariff revenue for B due to trade diversion.

It is clear that the formation of a preferential trading agreement with respect to a particular good will result (given the condition of sufficient substitutability) in a gain to one country and a loss to the other member of the club. However the loser can be exactly compensated for his lost revenue by the other, which still retains all the terms of trade gain. Thus the club formation, with compensation, is welfare improving.[5]

Summing across (18)

$$(1 - t^a \cdot c_y^a)e_u^a du^a + (1 - t^b \cdot c_y^b)e_u^b du^b = t^{a'} s^a \Delta^a - t^{b'} s^b \Delta^b > 0,$$

with the substitutability condition fulfilled. The net benefit to the club is from the improvement in domestic terms of trade.

Clearly the optimal trade policy for each of the two small countries would be the elimination of all trade taxes, both intra-club and extra-club. Suppose, however, that extra-club taxes were to be maintained at their present level.[6] What then would be the optimal rates of intra-club taxes on trade? In Appendix 2, an experiment is conducted to determine A's optimal tariff on imports. It is demonstrated that this tariff should be proportionately less than other tariffs, but need not be zero. Thus, as would be expected, the second-best optimum tariff[7] in the face of other distortions differs from the first-best (zero) tariff.[8]

5. A AND B AS "LARGE" COUNTRIES

Suppose that the changes in production and consumption induced by the formation of the preferential trading club affect both the domestic prices of C and the extra-club international price structure. The impact of changes in the terms of trade may be determined by substituting equation (17) into the equations of (16):

$$M\begin{bmatrix} e_u^a\, du^a \\ e_u^b\, du^b \\ e_u^c\, du^c \end{bmatrix} = \begin{bmatrix} t^{a'} s^a \Delta^a + m^{ab} dT \\ -t^{b'} s^b \Delta^b + m^{ba} dT \\ 0 \end{bmatrix} + \begin{bmatrix} B^a \\ B^b \\ B^c \end{bmatrix} (s^b \Delta^b - s^a \Delta^a) \qquad (20)$$

where
$$M = \begin{bmatrix} A^a & B^a c_y^b & B^a c_y^c \\ B^b c_y^a & A^b & B^b c_y^c \\ B^c c_y^a & B^c c_y^b & A^c \end{bmatrix}$$

and $$B^j = (t^{j'} s^j - m^{j'}) s^{-1} \quad , \quad \text{for } j = a,b,c$$

$$A^j = (1 - t^j \cdot c_y^j) + B^j c_y^j \quad , \quad \text{for } j = a,b,c$$

Solving,
$$\begin{bmatrix} e_u^a \, du^a \\ e_u^b \, du^b \\ e_u^c \, du^c \end{bmatrix} = \frac{1}{D} \begin{bmatrix} \alpha_{11} & \alpha_{21} \\ \alpha_{12} & \alpha_{22} \\ \alpha_{13} & \alpha_{23} \end{bmatrix} \begin{bmatrix} t^{a'} s^a \Delta^a \\ -t^{b'} s^b \Delta^b \\ 0 \end{bmatrix}$$
$$+ \frac{1}{D} \begin{bmatrix} \alpha_{11} - \alpha_{21} \\ \alpha_{12} - \alpha_{22} \\ \alpha_{13} - \alpha_{23} \end{bmatrix} m^{ab} \cdot dT$$
$$+ \frac{1}{D} \begin{bmatrix} \alpha_{11} & \alpha_{21} & \alpha_{31} \\ \alpha_{12} & \alpha_{22} & \alpha_{32} \\ \alpha_{13} & \alpha_{23} & \alpha_{33} \end{bmatrix} \begin{bmatrix} B^a \\ B^b \\ B^c \end{bmatrix} (s^b \Delta^b - s^a \Delta^a), \qquad (21)$$

where the α_{ij} are the cofactors of the elements of M, and D is its determinant.

Consider the welfare impact on A of the formation of the club

$$e_u^a \, du^a = \frac{1}{D}[\alpha_{11} t^{a'} s^a \Delta^a - \alpha_{21} t^{b'} s^b \Delta^b] + \frac{1}{D}(\alpha_{11} - \alpha_{21}) m^{ab} \cdot dT$$
$$+ \frac{1}{D}[\alpha_{11} B^a + \alpha_{21} B^b + \alpha_{31} B^c][s^b \Delta^b - s^a \Delta^a] \qquad (22)$$

The first term is the "large-country" analogue to the terms of trade gain from club formation. It was shown previously that, with assumptions of substitutability,

$$t^{a'} s^a \Delta^a > 0, \; t^{b'} s^b \Delta^b < 0.$$

Thus, if α_{11}/D and α_{21}/D are positive, country A gains both from its own trade liberalization and that of its partner for trade pattern A-B-C.

The second term's sign depends upon the trade pattern. For B-A-C, A is lowering duties on trade with only one of the countries with which it trades a particular good and thereby loses tax revenues. This has been termed "trade diversion" and will be welfare worsening if $(\alpha_{11} - \alpha_{21})/D > 0$. A gains from the preferential terms of trade offered by B if the trade pattern is A-B-C.

The effect of induced changes in the world terms of trade are captured in the third term. The sign of this will depend upon the change in income in each country and their income elasticities of demand for A's export and import goods.

In the large-countries case, the welfare of C is also affected by the formation of the club.

$$\begin{aligned} e_u^c \, du^c = & \frac{1}{D}[\alpha_{13} t^{a'} s^a \Delta^a - \alpha_{23} t^{b'} s^b \Delta^b] \\ & + \frac{1}{D}[\alpha_{13} - \alpha_{23}] m^{ab} \cdot dT \\ & + \frac{1}{D}[\alpha_{13} B^a + \alpha_{23} B^b + \alpha_{33} B^c][s^b \Delta^b - s^a \Delta^a] \end{aligned} \qquad (23)$$

The third term of this equation, as in equation (22) reflects the effects changes in the external terms of trade on welfare. The first term captures the impact

on the welfare of C of A and B receiving intra-club terms of trade improvements. If α_{13}/D and α_{23}/D are positive, then C benefits from the increased desires for trade of A and B as a result of their forming the club. The second term reports the net effect on C of trade diversion. Within the club, one member country loses tariff revenue, the other receives improved terms of trade; the impact on C will depend on whether or not the club's net trade with C increases. For example, with trade pattern B-A-C, if A reduces its import tariff on a good X, $m_x^{ab} \cdot dT_x < 0$. A's trade with C will fall (if $\alpha_{13}/D > 0$) and B's trade will rise. If $\alpha_{13}/D > \alpha_{23}/D$ then A's lost revenues will inflict a greater loss on C's welfare than could be compensated by B's increased desire for trade. If $\alpha_{13} = \alpha_{23}$, the gain from one country exactly offsets the loss from the other and C's welfare is unaffected. Similarly, a scheme of compensation payments between A and B (to remove the ill-effects of trade diversion on club formation) would nullify the impact on C.

It is clear that a preferential trading club that is mutually beneficial to its members is one that yields the "small countries" benefits of improved intra-club terms of trade (assuming compensation for lost tax revenues) while not inducing sufficiently adverse changes in the extra-club terms of trade.

6. SUMMARY

An attempt has been made to discuss preferential trading agreements in a model sufficiently general to include all patterns of trading. It was assumed throughout that the club formation would not alter the specific pattern of trade and that the only distortions in the world economy were trade taxes.

Small countries can gain from a preferential trading club only if their domestic exports are substitutes for goods imported from the partner alone and if their imports are substitutes for the goods exported only to the partner. Free trade within the club is not necessarily optimal. When the partners are large countries, the benefits of improved intra-club terms of trade will be augmented or diminished dependent on the movements in the world terms of trade.

It has been assumed throughout that extra-club duties are invariable. An obvious extension of this analysis would be to consider the optimal external taxes for the club for the large-countries case.

Footnotes

*I am indebted to Jim Markusen, John McMillan, and Jim Melvin for helpful comments and criticisms of earlier drafts of this paper: the usual disclaimer applies.

[1]Of course, this latter assumption contrasts strongly with the standard 2-good analysis in which most of the action occurs in the change of trade pattern.

[2]In a 2-good model, A and B import different goods and so a free trade area and a customs union are equivalent [for example, in Negishi (1972)].

[3]This reflects Viner's (1950) distinction between nominal and effective protective duties.

[4]There has been a bewildering variety of uses for the term "trade diversion". The use here is intended to be in consonance with the traditional definition: that the tariff reduction redirects trade from the lower-cost to the higher-cost country with the consequent loss of tariff revenue.

[5]This was pointed out by Kemp (1969, p. 31).

[6]Obviously A and B's optimal taxes on A-C-B trade would be zero as they are both small with respect to the country with which they trade.

[7]This terminology was coined by Lipsey (1970, p. 36).

[8]McMillan and McCann (1981), in their model with complete specialization, showed that, under particular circumstances, the second-best optimum tariff can be negative. This would imply subsidization of intra-club trade.

[9]Wonnacott and Wonnacott (1981) discuss the benefits from customs union formation under the circumstances of both a change in the pattern of trade and in the presence of transport costs.

References

Berglas, E. (1979). "Preferential Trading Theory: The n Commodity Case." Journal of Political Economy, vol. 87 (April), pp. 315-32.

_____ (1983). "The Case for Unilateral Tariff Reductions: Foreign Tariffs Rediscovered." American Economic Review, vol. 73 (December), pp. 1141-42.

Chacholiades, M. (1978). International Trade Theory and Policy. New York: McGraw-Hill.

Collier, P. (1979). "The Welfare Effects of Customs Unions: An Anatomy." Economic Journal, vol. 89 (March), pp. 84-95.

Corden, W. M. (1976). "Customs Union Theory and the Nonuniformity of Tariffs." Journal of International Economics, vol. 6 (February), pp. 99-100.

Dixit, A. K. and Norman, V. (1980). Theory of International Trade. Welwyn: James Nisbet.

Kemp, M. C. (1969). A Contribution to the General Equilibrium Theory of Preferential Trading. Amsterdam: North-Holland.

_____ and Wan, H. (1976). "An Elementary Proposition Concerning the Formation of Customs Unions," in M. C. Kemp, Three Topics in the Theory of International Trade. Amsterdam: North-Holland.

Lipsey, R. G. (1970). The Theory of Customs Unions: A General Equilibrium Analysis. London: Weidenfeld and Nicolson.

Lloyd, P. J. (1974). "3X3 Theory of Customs Unions." Journal of International Economics, vol. 12 (February), pp. 41-63.

McMillan, J. and McCann, E. (1981). "Welfare Effects in Customs Unions." Economic Journal, vol. 91 (September), pp. 697-703.

Meade, J. E. (1955). The Theory of Customs Unions. Amsterdam: North-Holland.

Melvin, J. R. (1969). "Comments on the Theory of Customs Unions." Manchester School, vol. 36 (June), pp. 161-8.

Mundell, R. A. (1964). "Tariff Preferences and the Terms of Trade." Manchester School of Economic and Social Studies, January, pp. 1-13. Reprinted in R. A. Mundell (1968), International Economics. London: Collier-Macmillan, pp. 54-64.

Negishi, T. (1972). General Equilibrium Theory and International Trade. Amsterdam: North-Holland.

Petith, H. C. (1977). "European Integration and the Terms of Trade." Economic Journal, vol. 87 (June), pp. 262-272.

Riezman, R. (1979). "A 3X3 Model of Customs Unions." Journal of International Economics, vol. 9 (August), pp. 341-54.

Vanek, J. (1965). General Equilibrium of International Discrimination: The Case of Customs Unions. Cambridge, Mass.: Harvard University Press.

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

Wonnacott, P. and Wonnacott, R. (1981). "Is Unilateral Tariff Reduction Preferable to a Customs Union? The Curious Case of the Missing Foreign Tariffs." American Economic Review, vol. 71 (September), pp. 704-13.

Appendix A

Partition the set of n goods into 6 subsets according to the following

n_1: trade pattern A-B-C, B exports goods

n_2: trade pattern A-B-C, B imports goods

n_3: trade pattern B-A-C, A exports goods

n_4: trade pattern B-A-C, A imports goods

n_5: trade pattern A-C-B, C exports goods

n_6: trade pattern A-C-B, C imports goods.

In this case, making similar partitions,

$$\Delta_1^a = dt_1^{ai} - dt_1^{bi} < 0 \text{ , i.e., all elements negative}$$
$$\Delta_2^a = dt_2^{ai} - dt_2^{bi} > 0$$
$$\Delta_k^a = 0 \text{ , } k=3,4,5,6$$

$$t^{a'} s^a \Delta^a = (t_1^{a'} t_2^{a'} t_3^{a'} t_4^{a'} t_5^{a'} t_6^{a'}) \begin{bmatrix} s_{11}^a & s_{12}^a \\ s_{21}^a & s_{22}^a \\ s_{31}^a & s_{32}^a \\ s_{41}^a & s_{42}^a \\ s_{51}^a & s_{52}^a \\ s_{61}^a & s_{62}^a \end{bmatrix} \begin{bmatrix} \Delta_1^a \\ \Delta_2^a \end{bmatrix} \qquad \text{(A1)}$$

Assume, for simplicity, that A's import tariffs are all the same proportion of the domestic prices and that export taxes are also a common proportion of domestic prices

i.e., import tariff, $t_k^a = \tau^a p_k^a$, $k=1,3,5$, $\tau^a > 0$

export tax, $t_k^a = -\sigma^a p_k^a$, $k=2,4,6$, $\sigma^a > 0$

Then,

$$t^{a'} s^a \Delta^a = \tau^a \{p_1^{a'} s_{11}^a + p_3^{a'} s_{31}^a + p_5^{a'} s_{51}^a\}\Delta_1^a - \sigma^a \{p_2^{a'} s_{21}^a + p_4^{a'} s_{41}^a + p_6^{a'} s_{61}^a\}\Delta_1^a$$
$$+ \tau^a \{p_1^{a'} s_{12}^a + p_3^{a'} s_{32}^a + p_5^{a'} s_{52}^a\}\Delta_2^a - \sigma^a \{p_2^{a'} s_{22}^a + p_4^{a'} s_{42}^a + p_6^{a'} s_{62}^a\}\Delta_1^a \quad \text{(A2)}$$

From equation (10), $s^a p^a = 0 \Rightarrow p^{a'} s^{a'} = 0$. s^a is symmetric and so $p^{a'} s^a = 0$.

Thus

$$p_1^{a'} s_{1j}^a + p_2^{a'} s_{2j}^a + p_3^{a'} s_{3j}^a + p_4^{a'} s_{4j}^a + p_5^{a'} s_{5j}^a + p_6^{a'} s_{6j}^a = 0 \quad \text{(A3)}$$

for j=1,...,6.

Substituting into (A2)

$$t^{a'} s^a \Delta^a = -(\tau^a + \sigma^a)(p_2^{a'} s_{21}^a + p_4^{a'} s_{41}^a + p_6^{a'} s_{61}^a)\Delta_1^a + (\tau^a + \sigma^a)(p_1^{a'} s_{12}^a + p_3^{a'} s_{32}^a + p_5^{a'} s_{52}^a)\Delta_2^a$$

For a welfare gain from changes in the terms of trade, need

$$(p_2^{a'} s_{21}^a + p_4^{a'} s_{41}^a + p_6^{a'} s_{61}^a)\Delta_1^a - (p_1^{a'} s_{12}^a + p_3^{a'} s_{32}^a + p_5^{a'} s_{52}^a)\Delta_2^a < 0$$

This requires that at least one of the bracketed expressions to be positive, i.e., that either or both of the following conditions holds:

(i) A's exports to B, that are facing improved world prices, are substitutes in consumption and production for A's imports.

(ii) A's imports from B, that have falling domestic prices, are substitutes in consumption and production for A's exports.

Appendix B

The optimal import taxes, $\hat{t}_1^a$, will maximize the terms of trade benefits. That is, from equation (A1)

$$\{\hat{t}_1^{a'} s_{11}^a + t_2^{a'} s_{21}^a + t_3^{a'} s_{31}^a + t_4^{a'} s_{41}^a + t_5^{a'} s_{51}^a + t_6^{a'} s_{61}^a\}\Delta_1^a = 0$$

Suppose, as before for simplicity, that import tariffs and export taxes on other goods are uniform. Then

$$\{(\hat{t}_1^{a'} - \tau p_1^{a'})s_{11}^a + \tau^a(p_1^{a'} s_{11}^a + p_3^{a'} s_{31}^a + p_5^{a'} s_{51}^a) - \sigma^a(p_2^{a'} s_{21}^a + p_4^{a'} s_{41}^a + p_6^{a'} s_{61}^a)\}\Delta_1^a = 0$$

Substituting equation (A3) into this

$$(\hat{t}_1^{a'} - \tau^a p_1^{a'})s_{11}^a\Delta_1^a - (\tau^a + \sigma^a)(p_2^{a'} s_{21}^a + p_4^{a'} s_{41}^a + p_6^{a'} s_{61}^a)\Delta_1^a = 0$$

For a welfare improvement, the last expression must be negative [see Appendix A] and so

$$(\hat{t}_1^{a'} - \tau^a p_1^{a'})s_{11}^a\Delta_1^a < 0$$

The optimal tariff must be (proportionately) less than the tariff on other imports, but is not necessarily zero.

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