Tariff Adjustments in Preferential Trade Agreements

by

Eric W. Bond

and

Constantinos Syropoulos

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Abstract

In this paper we examine how preferential trade liberalization affects the terms of trade, external tariffs and welfare of the integrating countries and the rest of the world. Our analysis is based on a three-country, three-good, general equilibrium model with symmetric customs union (CU) members. The model generalizes previous work by considering more general consumer preferences and production, which allows for the possibility that exports of CU members are complements for exports of the rest of the world. We find that Kemp-Wan tariff adjustments require a decrease (increase) in the external tariff of signatories to a preferential trade agreement to accompany internal liberalization in the neighborhood of internal free trade when member goods are substitutes (complements) for those of non-members. In contrast to the analysis based on special case of CES consumer preferences, the adjustment path of the external tariff to reductions in the internal tariff could be non-monotonic when preferences are general. Our results are of interest for the design of rules for multilateral trade agreements with respect to preferential liberalization, since they indicate how tariffs must be adjusted to eliminate negative impacts on non-member countries.

Keywords: Preferential trade agreements, Kemp-Wan tariff adjustments, optimal tariffs

Eric W. Bond, Department of Economics, Vanderbilt University, VU Station B #351819, 2301 Vanderbilt Place, Nashville, TN 32735-1819, Phone: (615) 232-2388; E-mail: eric.bond@vanderbilt.edu

Constantinos Syropoulos, Department of Economics and International Business, Lebow College of Business - Drexel University, 503 - N Matheson Hall, 32nd and Market Streets, Philadelphia, PA 19104; Phone: (215) 895-2792; E-mail: c.syropoulos@drexel.edu
1. Introduction

The question of how countries that have formed preferential trade agreements (i.e., customs unions or free trade areas) adjust their external tariffs in response to the liberalization of intra-union trade is central in evaluating the desirability of dismantling trade barriers preferentially and in assessing their impact on the multilateral trading system. Arguably, if preferential trade agreements (PTAs) result in a more aggressive policy stance against non-member countries (or if they induce the excluded countries to respond more aggressively), PTAs may be a stumbling block to multilateral trade liberalization. On the other hand, if PTAs induce their constituent members to adopt less aggressive external trade policies, then their effects on the international trading system may be more benign.

In a series of papers (Bond and Syropoulos (1996a, 1996b), Bond, Syropoulos and Winters (2001) and Bond, Riezman and Syropoulos (2004)) we used a simple three-country endowment model of trade with CES preferences to address the above issues under alternative assumptions about the nature of strategic interactions between countries and the nature of PTAs. By assuming that PTA members were symmetric in their preference and endowment structures, we were able to characterize the effects of PTAs using three tariffs: the external and internal tariffs of the representative PTA member and the tariff of the outside country. In that setting we were able to show how PTA members and the rest of the world are affected by internal trade liberalization.

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1 This endowment/country structure in our model is an extension of Krugman (1991) that makes it possible to consider the role played by differences in country size and the degree of comparative advantage. In Bond and Syropoulos (1996a,b) we examined how an increase in the size of trading blocs affects world welfare when each trading bloc takes the form of a customs union and sets its external tariff against the rest of the world optimally. In Bond, Syropoulos and Winters (BSW, 2001) we allowed the interaction between countries to be repeated over time so that multilateral trade negotiations may sustain cooperative tariff levels that represent a Pareto improvement over the one-shot Nash equilibrium. This framework enabled us to examine how preferential trade liberalization affects the sustainability of multilateral trade agreements. Lastly, in Bond, Riezman and Syropoulos (BRS, 2004) we examined the case in which countries form free trade areas (FTAs), rather than customs unions (CUs), under the assumption that individual countries set their external tariffs independently to maximize national welfare.
under alternative processes regarding the determination of the external tariff. An important benchmark in our analysis was a Kemp-Wan tariff adjustment; that is, an adjustment in the external tariff that is necessary to leave the non-member country’s welfare unaffected by trade liberalization. By comparing the response of the external tariff to internal trade liberalization, we were able to identify how preferential liberalization affects the rest of the world and PTA members.

While the endowment model with CES preferences provides a simple environment within which to explore these issues, the adoption of specific functional forms raises questions about the generality of the results obtained. In this paper we explore the effects of preferential tariff reductions using more general production and preference structures. More specifically, we maintain the assumption that union members are symmetric in size and comparative advantage; however, we consider a general structure in which the restriction of symmetry is imposed on general expenditure and revenue functions. This approach has the advantage of allowing for a richer production structure while still permitting us to express trade policy in terms of the same tariffs: the internal tariff of the PTA, its external tariff, and the tariff of the non-member. The resulting analysis, which can be carried out in terms of a representative PTA member and the outside country, is simplified because it retains many of the features of a two-country trade model.

Section 2 presents the key ingredients of the model and briefly summarizes the restrictions on excess demand functions that result from our symmetry assumptions. One generalization resulting from this production structure is that it admits the possibility that imports from union partner may be complementary to imports from the rest of the world.

Section 3 derives the effect of changes in tariffs on world prices and characterizes the nature of the Kemp-Wan tariff adjustment. It is shown that, in the neighborhood of internally free trade,
a Kemp-Wan tariff adjustment calls for a reduction (increase) in the external tariff following the liberalization of internal trade when member and non-member imports are substitutes (complements) for member countries. When internal tariffs are positive, it is possible for internal trade liberalization to have positive spillovers to the rest of the world even in the absence of complementarity in import demand functions.

Focusing on the case of customs unions, Section 4 examines the relationship between trade policy and welfare for member countries. We derive an optimal tariff formula for the external tariff as a function of the internal tariff that can be expressed as a simple extension of the two-good optimal tariff formula. We also derive an optimal formula for the internal tariff, given the level of the external tariff. The results of the general model are then compared with those obtained in the CES/endowment model utilized in our earlier work. Section 5 discusses some potential extensions of this work.

2. A Symmetric Three-Country Trade Model
We consider a model in which three countries, labeled 1, 2 and 3, exchange three final goods, also labeled 1, 2 and 3, in perfectly competitive markets. To explore the implications of preferential trading arrangements we single out countries 1 and 2 as the potential members for a customs union (CU), and designate country 3 as the outside country, or the rest of the world (ROW). Each country $i$ is an exporter of good $i$ and an importer of the remaining products. Importantly, for tractability, we assume that potential union members are symmetric relative to each other and relative to ROW in the sense that we describe below.

Denote with $p^i_j$ the price of good $j$ in country $i$. We assume that consumer preferences are identical across countries and that they are described by the expenditure function $E(p_1, p_2, p_3, U)$. 
This function is increasing in its arguments, concave in prices and satisfies the symmetry condition

\[ E(a, b, p_3, U) = E(b, a, p_3, U) \quad \text{for all} \quad a, b, p_3 > 0. \quad (1) \]

We also assume that all goods are normal in consumption. The production technology in each country \( i \) is described by the revenue function \( R^i(p_1, p_2, p_3) \), which is increasing and convex in prices. The symmetry conditions imposed on the production side are

\[ R^1(a, b, p_3) = R^2(b, a, p_3) \quad (2a) \]
\[ R^3(a, b, p_3) = R^3(b, a, p_3) \quad (2b) \]

for goods 1 and 2 at all prices \( a, b, p_3 > 0 \). Countries 1 and 2 are assumed to differ symmetrically in their ability to produce goods 1 and 2. This could arise because of differences in endowments across countries that have identical technologies (e.g., different quantities of sector-specific factors in a specific factors model) or because of differences in technologies. Since the source of this difference is not essential to our analysis, we suppress factor endowments and simply characterize the revenue functions as being country-specific functions of prices.

Using the standard properties of expenditure and revenue functions, we can define the compensated excess demand function for good \( j \) in country \( i \) as

\[ M^i_j(p, U) = \frac{\partial E^i(p, U)}{\partial p_j} - \frac{\partial R^i(p)}{\partial p_j} \]

where \( p \) is a vector of prices. The symmetry conditions on preferences and technologies (or on
resource endowments) imply several restrictions on the excess demand functions. For the
non-member country, we have

\[ M_1^3(a, b, p_3, U) = M_2^3(b, a, p_3, U), \quad M_3^3(a, b, p_3, U) = M_3^3(b, a, p_3, U) \] (3)

In addition to the usual symmetry conditions imposed by optimization, the second
expression in (3) yields symmetry of substitution effects between the imports from the member
countries, \( M_{31}^3 = M_{32}^3 \), where \( M_{jk}^i = \partial M_j^i / \partial p_k \). When combined with the homogeneity of degree
zero of excess demand functions, this ensures that goods 1 and 2 are necessarily net substitutes for
good 3 in country 3 (i.e. \( M_{31}^3 = M_{32}^3 > 0 \)).

For member countries the symmetry conditions in (1) and (2) imply

\[ M_1^1(a, b, p_3, U) = M_2^1(b, a, p_3, U), \quad M_2^1(a, b, p_3, U) = M_1^2(b, a, p_3, U), \]
\[ M_3^1(a, b, p_3, U) = M_3^2(b, a, p_3, U). \] (4)

The conditions imposed on substitution effects by symmetry for the member countries will be
somewhat weaker than for the non-member country because the prices of goods 1 and 2 do not
enter symmetrically in the individual country revenue functions. In the case of an endowment
model with preferences that are separable in member country goods (i.e., \( E(\phi(p_1, p_2), p_3, U) \)), we
have \( E_{31}^i = M_{31}^i = E_{32}^i = M_{32}^i > 0 \) for \( i = 1, 2 \), as in our earlier work that utilized CES preferences.
However, there exist production models that generate \( R_{31}^i < 0 \), in which case \( M_{31}^i < 0 \), if the
substitution effects in demand are sufficiently small.\textsuperscript{2} Thus, goods 1 and 2 can be either net substitutes or net complements for good 3 for PTA members.

Letting \( q_i \) denote the world price of good \( i \) and choosing good 3 as the numeraire, it is easy to show that the model will have a unique free trade equilibrium in which \( q_1 = q_2 \) and \( U^1 = U^2 \). The symmetry of demand and supply functions for goods 1 and 2 will ensure that their relative prices will be equal in equilibrium. Since \( M_1^3 = M_2^3 \), there will be two trade patterns that are potentially of interest. The first arises if country \( i \) exports good \( i \) and imports good \( j \neq i \) from country \( j \).\textsuperscript{3} The second arises if country \( i \) imports good \( i \) from each of the other two countries. In this paper we will focus on the former case, which is the trade pattern assumed in BSW (2001) and BRS (2004).

With the assumed trade pattern in which country \( i \) exports good \( i \) and imports good \( j \neq i \), country \( i \)’s trade policy can be summarized by the tariff \( \tau^i_j \) (which is the ad valorem tariff rate plus one) imposed by country \( i \) on its imports of good \( j \neq i \). Domestic prices for good \( i \) will be \( p^i_i = q_i \) and \( p^i_j = \tau^i_j q_j \) for \( j \neq i \). For brevity, we will refer to \( \tau^i_j \) as “the tariff.” Moreover, for simplicity we will occasionally identify ROW variables with an asterisk. In light of the aforementioned symmetry conditions, the following restrictions of symmetry in trade policy will also be imposed:

\begin{itemize}
  \item \textsuperscript{2} An example of this is the model of Gruen and Corden (1970), in which sectors 1 and 2 employ labor and capital and good 3 employs labor and land. Since the returns to labor and capital are determined by the zero profit conditions for goods 1 and 2 (assuming both goods are produced), an increase in the capital-intensive good will reduce the return to labor from the Stolper-Samuelson effect. The reduction in the cost of labor will expand production of good 3. A second example would be one in which each country consumes only its own output, but uses the outputs of each of the other two countries’ goods as inputs to production of its output. In this case an increase in the price of country 2’s output would reduce the total scale of country 1’s output, leading to a reduction in the purchases of inputs from country 3. It should be emphasized that these cases of complementarity cannot be tied to the characteristics of goods 2 and 3 themselves, because the complementarity for country 2 must be between goods 1 and 3.
  \item \textsuperscript{3} There is also a case consistent with \( M_1^3 = M_2^3 > 0 \) in which \( M_1^1 = M_2^1, M_1^2 = M_2^2 < 0 \) at free trade. This is of less interest to the analysis of preferential liberalization agreements between countries 1 and 2 because there will be no need for these countries to trade with each other.
\end{itemize}
(C1) \[ t = \tau_1^1 = \tau_2^1 \] common (internal) tariff on intra-union imports
(C2) \[ \tau = \tau_3^1 = \tau_3^2 \] common external tariff on imports from ROW
(C3) \[ \tau^* = \tau_1^3 = \tau_2^3 \] common tariff imposed by ROW

While these conditions are treated here as assumptions about policy, they can in fact be derived as outcomes of tariff setting processes under a variety of different assumptions about government objectives.4

The symmetry conditions (1)-(3) and (C1)-(C3) will ensure that the pre-tariff prices of goods 1 and 2 will be equal, so that the terms of trade between the union members and ROW can be summarized by a single relative price. Choosing good 3 as numeraire, an equilibrium in product markets with \( q = q_1 = q_2 \) and \( U^1 = U^2 \) will hold if there exist \( \{q, U^1, U^3\} \) satisfying

\[
q M_1^1(q, tq, \tau, U^1) + q M_1^3(q, tq, \tau, U^1) + M_3^1(q, tq, \tau, U^1) = 0 \tag{5}
\]
\[
2q M_1^3(\tau^* q, \tau^* q, 1, U^3) + M_3^3(\tau^* q, \tau^* q, 1, U^3) = 0 \tag{6}
\]
\[
M_3^1(q, tq, \tau, U^1) = q M_3^3(\tau^* q, \tau^* q, 1, U^3). \tag{7}
\]

Equation (5) describes the budget constraint of country 1 (the representative union member) and (6) captures country 3’s budget constraint. Equation (7) is the condition for balanced trade with

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4 If tariffs are set optimally, then (C3) will be a characteristic of ROW policy given (C1) and (C2). Similarly, (C2) would follow from optimal choice of member country policies given (C1) and (C3). If tariffs are the outcome of a bargaining process between countries, then it is natural to assume symmetry of bargaining power between symmetric member countries, which would also satisfy these conditions.
ROW and implicitly defines the world price $q$ as a function of tariffs.

Before proceeding with the analysis, it will be useful to define three elasticities that appear frequently in the subsequent discussion. It will also be useful to identify the restrictions on these elasticities imposed by our symmetry assumptions.

Let

$$\eta \equiv \frac{\partial M^3_1(q, tq, \tau, U^1)}{\partial q} \frac{q}{M^3_2} = -\tau \frac{M^3_{13}}{M^3_2} > 0$$

denote the compensated elasticity of demand of country 1 imports from 3 with respect to $q$. The inequality in this expression follows from the homogeneity of degree zero of import demands and the sign from the concavity of the expenditure function. Similarly, we define the compensated import demand elasticity for the non-member country as

$$\eta^* \equiv -\frac{\partial M^3_1(\tau^* q, \tau^* q, 1, U^3)}{\partial q} \frac{q}{M^3_2} = \frac{M^3_{13}}{M^3_1} > 0,$$

since $M^3_{13} > 0$ as argued earlier. Lastly, we define the compensated cross price elasticity of demand for a member country’s imports from the non-member country as

$$\mu \equiv \frac{\partial M^3_1(q, tq, \tau, U^1)}{\partial p^1_2} \frac{p^1_2}{M^3_2} = \frac{tq M^3_{12}}{M^3_1}.$$ 

This elasticity will be positive or negative depending on whether goods 2 and 3 are net substitutes or net complements. As noted in the discussion of (4), the separability assumptions we impose
here allow for the possibility that goods 2 and 3 to be net either substitutes or net complements.

3. **Tariffs and the Terms of Trade**

Since terms of trade play a crucial role in determining the impact of a preferential trade agreement on ROW, we begin by deriving the relationship between the tariff rates noted above and the terms of trade. In models in which policymakers aim to maximize national, changes in domestic policy affect ROW through their impact on the terms of trade. Thus, in the Kemp and Wan (1976) proposition, the impact of the PTA on ROW is neutralized by adjusting external tariffs so that terms of trade remain unaffected. Bagwell and Staiger (2002) show that, for an important class of political economy models, the sole spillover of changes in domestic policy to ROW operates through the terms of trade.

The effect of policy changes on the terms of trade can be obtained by totally differentiating system (5)-(7) and solving. Totally differentiating the market-clearing condition (7) and using the homogeneity of degree zero property of import demand functions yields

\[
(\eta + \eta^* - 1) \hat{q} = \eta \hat{t} - \mu \hat{t} - \eta^* \hat{t}^* - \frac{M^1_{1U}}{M^1_3} dU^1 + \frac{M^3_{1U}}{M^3_1} dU^3,
\]

where a hat (“^”) over a variable denotes a rate of change. The right-hand side indicates that an increase in a representative member country’s external tariff (a decrease in the non-member country’s tariff) will shift demand toward exports of the member countries at given \(q\) and real income levels. The impact of a change in \(t\) will be to lower (raise) the demand for member country goods if good 2 is a substitute (complement) for good 3.

Since the utility levels in (8) are endogenous, we must also differentiate the budget
constraints to solve for the equilibrium impact. Differentiating the non-member country’s budget constraint (6) and rearranging terms gives

\[ A^* dU^3 = -2qM_1^3\{[1 + (\tau^* - 1)\eta^*]q + (\tau^* - 1)\eta^*t^*\}, \]  

(9)

where \( A^* \equiv 2qM_{1U}^3 + M_{3U}^3 > 0 \) due to normality of goods in consumption. Note that in deriving (9) we have used the homogeneity (of degree zero) of the import demand functions in prices and the result that \( M_{31}^3 = M_{32}^3 > 0 \). At fixed terms of trade \( q \), an increase in \( \tau^* \) reduces welfare when \( \tau^* > 1 \) because it causes the volume of trade to contract. This effect is larger the larger the compensated price elasticity of demand for imports. Welfare is decreasing in \( q \) (the world price of country 3’s imports) because such a price increase generates adverse terms of trade and volume of trade effects. Equation (9) is the standard result in the two-good case and arises here because goods 1 and 2 can be treated as a composite commodity from the point of view of country 3 (the country outside the PTA).

For the representative member country in the PTA, the welfare decomposition is more complicated for two reasons. First, the potential for differential treatment of imports from member and non-member countries generates an additional tariff term. Second, the symmetry conditions do not completely eliminate the possibility that two of the goods may be net complements. Totally differentiating (5) gives

\[ AdU^1 = M_3^1\left(\left[1 + (\tau - 1)\eta - \frac{\tau(t-1)}{t}\mu\right]\hat{q} - \left[(\tau - 1)\eta - \frac{\tau(t-1)}{t}\mu\right]\hat{t}\right) \]

(10)
\[ +M_3^1 \left[ (\tau - 1)\mu + \frac{(t-1)q^2M_{22}^1}{M_3^1} \right]^e \]

where \( A \equiv q(M_{1U}^1 + M_{2U}^1) + M_{3U}^1 > 0. \) At constant terms of trade \( q, \) an increase in the external tariff \( \tau \) affects welfare of PTA member 1 through its impact on the volume of distorted trade. When intra-union trade is free (i.e., when \( t = 1 \)) and \( \tau > 1, \) an increase in \( \tau \) will have a negative effect on welfare because it will reduce the volume of trade with the non-member. However, when \( t > 1, \) an increase in \( \tau \) will increase (decrease) the volume of trade with the PTA partner when \( \mu > 0 \) \((< 0)\) which is a favorable (unfavorable) trade volume effect. Combining these two effects, it is convenient to introduce the following definition which will play a significant role in the welfare expressions below:

**Definition 1:** An increase in the external tariff, \( \tau, \) will have an unfavorable trade volume effect if

\[ \Gamma_\tau = \tau \left[ \left( \frac{\tau - 1}{\tau} \right) \eta - \left( \frac{t - 1}{t} \right) \mu \right] > 0. \]

If \( \mu < 0, \) this condition will hold for all \( t > 1 \) and \( \tau > 1. \) If \( \mu > 0, \) \( \Gamma_\tau > 0 \) is more likely the greater are external barriers, \( \frac{\tau - 1}{\tau}, \) relative to internal barriers, \( \frac{t - 1}{t}, \) and the greater is the own price compensated import demand elasticity, \( \eta, \) relative to the cross price elasticity, \( \mu. \) The fact that imports from non-members are imperfect substitutes means that it is illegitimate to automatically impose \( \tau > t \) as a definition of preferential trade agreements. However, there is a presumption that the internal tariff barrier will be relatively lower in a preferential trade agreement. If \( \tau > t, \) then a sufficient condition for the trade volume changes due to a reduction in \( \tau \) to increase welfare is \( \eta \geq \mu. \) Since we know from the homogeneity of degree zero of import demand functions in
prices that $\eta = \mu + qM^1_{31}/M^1_3$, this condition will hold as long as goods 1 and 3 are not net complements.

A similar ambiguity arises in the effect of changes in internal tariffs on the terms of trade when $t > 1$. An increase in $t$ reduces the volume of imports from country 2 (at fixed $q$ and $\tau$), and this has an adverse effect on welfare. However, an increase in $t$ also leads to an increase (decrease) in the volume of trade with the outside country if $\mu > 0$ ($< 0$) which is a favorable (unfavorable) effect. The effect on trade in good 3 must dominate in the neighborhood of $t = 1$, but could be reversed if $t$ is sufficiently large.

**Definition 2:** An increase in the internal tariff, $t$, will have a favorable trade volume effect if

$$\Gamma_t = (\tau - 1)\mu + \frac{(t-1)tq^2M^1_{22}}{M^1_3} > 0.$$ 

If goods 2 and 3 are net complements (i.e., $\mu < 0$), the trade volume effect of an increase in $t$ must be unfavorable. If goods 2 and 3 are net substitutes, the following conditions are more likely to give rise to a favorable trade volume effect: (i) a $\tau$ large relative to $t$, (ii) a large value of $\mu$ relative to the compensated elasticity of demand for good 2, $tqM^1_{22}/M^1_2$, and (iii) a large volume of trade in good 2 relative to 3, $qM^1_2/M^1_3$. Note, in particular, that if $t = \tau$ and all goods are net substitutes, then $\Gamma_t < 0$. When all goods are net substitutes, own substitution effects dominate cross effects and the adverse impact of an increase in $t$ on its own trade volume must exceed that on the other market. Thus, it may well be the case that the sign of $\Gamma_t$ will change over the process of internal tariff reduction when $\mu > 0$.

Finally, we note from (10) that an increase in $q$ will have both a terms of trade and a trade
volume effect on PTA member 1. The terms of trade effect of an increase in $q$ will have a favorable impact on country 1’s welfare because $M^1_1 + M^1_2 < 0$. The trade volume effect of an increase in $q$ is equivalent to that for a decrease in $\tau$, so the trade volume effect of an increase in $q$ is favorable iff $\Gamma_\tau > 0$.

The total impact of the trade policy instruments on the terms of trade can be found by substituting (9) and (10) into (8) and rearranging terms. Doing so yields

$$\frac{\bar{q}}{\tau} = \frac{1}{\Delta} \left( \eta + \frac{M^3_{IU}}{A} \Gamma_\tau \right) \quad \text{(11)}$$

$$\frac{\bar{q}}{\tau} = -\frac{1}{\Delta} \left( \mu + \frac{M^3_{IU}}{A} \Gamma_t \right) \quad \text{(12)}$$

$$\frac{\bar{q}}{\tau^*} = -\frac{\eta^*}{\Delta} \left[ 1 + \frac{2qM^3_{IU}}{A^*} (\tau^* - 1) \right]. \quad \text{(13)}$$

Note that $\Delta \equiv \varepsilon + \varepsilon^* - 1 > 0$ is the familiar Marshall-Lerner condition for market stability, where $\varepsilon$ and $\varepsilon^*$ are the Marshallian price elasticities of import demand functions for extra-union trade and can be written as:

$$\varepsilon = \eta + \frac{M^3_{IU}}{A} (1 + \Gamma_\tau) \quad \text{(14)}$$

$$\varepsilon^* = \eta^* + \frac{2qM^3_{IU}}{A^*} [1 + (\tau^* - 1)\eta^*]. \quad \text{(15)}$$

These expressions decompose each of the elasticities into a pure substitution effect and an income effect. The first term in each expression is the net substitution elasticity of the imports between the
union members and the non-member country’s imports with respect to their relative price, and it is positive. The remaining term is the income effect, which is the product of the marginal propensity to consume the union export goods (evaluated at world prices) and the impact of a change in the terms of trade on the respective country income.

Equation (13) shows that an increase in the non-member’s tariffs will worsen the terms of trade of the member countries as long as the market stability condition is satisfied. An increase in \( \tau^* \) reduces the demand for member country exports at given prices, and this effect is reinforced by its negative trade volume effect on non-member country income when \( \tau^* > 1 \). The remaining expressions in (12)-(15) are complicated by the fact that there are trade volume effects on both extra-union and intra-union trade. In order to provide some intuition, it is useful to start by considering the comparative statics in the neighborhood of free internal trade between member countries; that is, when \( t = 1 \).

In the absence of internal trade barriers, goods 1 and 2 command the same relative price in all locations and

\[
\Delta \equiv \eta \left[ 1 + \frac{M^1_u}{A} (\tau - 1) \right] + \eta^* \left[ 1 + \frac{2qM^3_u}{A^*} (\tau^* - 1) \right] + \left[ \frac{M^3_u}{A} - \frac{M^3_u}{A^*} \right].
\]

The expressions inside the brackets of the first two terms must be positive due to the compensated substitution effects when trade is not subsidized. The only potential source of instability arises from the last term, which is the difference in marginal propensities to consume good 3 (evaluated at world prices) between the member and non-member countries. An increase in \( q \) transfers purchasing power from non-member to member countries, which will be stabilizing (i.e., tending to raise the demand for the non-member’s good) if the member countries have a higher marginal
propensity to consume good 3. If preferences are homothetic as well as identical and there are no
tariff distortions at all, then this term will be zero and the Marshall-Lerner stability condition will
be satisfied. If marginal propensities to consume differ across countries, either because of
non-homotheticity or differences in internal relative prices, then the stability condition will be
satisfied as long as the substitution effects are sufficiently large.

Assuming that the stability condition is satisfied, in the case of \( t = 1 \) we have from (11)-(13)
that

\[
\bar{q} = \frac{1}{\Delta} \left\{ \eta \left[ 1 + \frac{M_{3u}}{M_3^2} (\tau - 1) \right] \hat{\tau} - \eta^* \left[ 1 + \frac{2qM_{3u}^2}{A} (\tau^* - 1) \right] \hat{\tau}^* - \mu \left[ 1 + \frac{M_{3u}}{M_3^2} (\tau - 1) \right] \hat{\tau} \right\}.
\]

(16)

The direction of the change in prices due to tariffs is determined by the compensated substitution
effects in this case, since the income effects arising from changes in trade volumes will operate in
the same direction as the substitution effects when goods are normal and trade is not subsidized.
An increase in \( \tau \) will improve the terms of trade of union members, and this improvement must be
less than the percentage increase in \( \tau \) when the difference in marginal propensities to consume
good 3 is sufficiently small. Similarly, an increase in \( \tau^* \) must result in a deterioration of the
member country’s terms of trade. An increase in \( t \) will shift demand toward (away from)
non-member goods and will thus worsen (improve) the member country’s terms of trade if \( \mu > 0 \) (\(<
0\)).

In the case of \( t > 1 \), the potential for paradoxical results are primarily associated with the
possibility of a reversal of trade volume effects from the case with \( t = 1 \). Referring to the
definition of \( \Delta \) it can be seen that the possibility that \( \Gamma_\tau < 0 \) is a potential source of market
instability when \( t > 1 \). For the comparative statics results, \( \Gamma_\tau > 0 \) is a sufficient condition for an
increase in \( r \) to improve the terms of trade for a member country. However, if \( \Gamma_r < 0 \) an increase in \( r \) could worsen the union’s terms of trade if the terms of trade effect is sufficiently large and the marginal propensity to consume good 3 is large. A similar result arises in the case of increases in \( t \). At \( t = 0 \), \( \frac{\partial q}{\partial t} = -\mu \). If \( \mu > 0 \), we could have \( \frac{\partial q}{\partial t} > 0 \) if \( \Gamma_r < 0 \) for \( t \) sufficiently large.

These results can be used to characterize the nature of the adjustment in external tariffs that must accompany a reduction in internal tariffs for the world price \( q \) to remain unaffected, which we refer to as Kemp-Wan adjustments. The Kemp-Wan adjustments can be characterized by \( \tau_K = \tau_K(t, q, \tau^*) \), which we christen Kemp-Wan tariff schedules.\(^5\) From (16) this requires \( \left( \frac{\partial \tau_K}{\partial \tau} \right)_{t=1} = \frac{\mu}{\eta} \) in the neighborhood of free internal trade.

We illustrate two Kemp-Wan schedules in the \( (t, \tau) \) space of union tariffs in Figures 1 and 2 for given ROW tariffs. These schedules are positively or negatively sloped when they cross the \( \tau \)-axis when the representative union member’s imports from ROW and its union partner are net substitutes (i.e., \( \mu > 0 \)) or net complements, (i.e., \( \mu < 0 \)) respectively. From (9) it can also be seen that, for given ROW tariffs, Kemp-Wan tariff adjustments by union members do not affect ROW welfare because they do not affect world prices. It follows that the \( \tau_K \) tariff schedules in Figures 1 and 2 also capture the welfare contours of ROW.

For \( t > 1 \), the expression for Kemp-Wan tariff adjustments becomes more complicated. Utilizing (11) and (12) we find

\[
\frac{\partial \tau_K}{\partial \tau} = \frac{\mu M_{x}^{1} N_{y}^{1}}{\eta M_{x}^{1} N_{y}^{1}},
\]

\( (17) \)

\(^5\) Srinivasan (1997) has addressed this question in the context of models with Cobb Douglas preferences and a variety of production models.
The elasticity of changes in $\tau_K$ with respect to changes in $t$ could depart from its value in the neighborhood of $t = 1$ (i.e., $\mu/\eta$) depending on how the trade volume effects change with $t$. For example, the above discussion suggested that if the initial point is one where $\tau = t$ and all goods are net substitutes, then $\Gamma_t < 0$, $\Gamma_\tau > 0$ and thus $\ddot{\tau}_K/\ddot{t} < \mu/\eta$. In addition, we have the possibility that the sign of (17) could be reversed for large values of $t$ if one of the trade volume effects gets reversed and is sufficiently large so that the income effect of the trade volume change dominates the substitution elasticity.

In the CES/endowment model case, which necessarily implies $\mu > 0$, we showed in BSW (2001) that $\frac{\tau_K}{t} = (1 + t^\sigma)^{-1}$, where $\sigma$ is the elasticity of substitution in consumption. In this case, Kemp-Wan tariff adjustments depend only on $t$ and always require internal trade liberalization to be followed by a reduction in the external tariff. The result for the CES case indicates that, if internal trade liberalization is a gradual process, the Kemp-Wan external tariff reduction would call for smaller percentage reductions in $\tau$ in the early stages of trade liberalization than at the later stages.

4. Tariffs and Member-Country Welfare

The results linking terms of trade to trade policy instruments can now be used to derive the relationship between trade policy instruments and the welfare of member countries. Our main goal in this section is to study the union’s optimal internal and external trade policies when ROW tariffs remain fixed at a pre-determined level. First, we examine the optimal external tariff policy of the union for given internal tariffs. Second, we derive the union’s optimal internal trade policies when external tariffs are kept fixed at non-prohibitive levels. We then investigate the
joint determination of optimal internal and external tariffs for the union (at constant ROW tariffs). The analysis enables us to describe the shape of the representative union member's (i.e., country 1's) welfare contours in \((t, \tau)\) space. It also enables us to link the analysis to Kemp-Wan tariff adjustments in external tariffs.

The effect of an increase in \(\tau\) on \(U^1\) is the sum of the direct (i.e., trade volume) effect and the effect operating through the induced change in the terms of trade. Substituting from (11) back into (10) we obtain

\[
\tau \frac{dU^1}{d\tau} = \frac{M_1^1}{\Delta \Lambda} [\eta - \Gamma \epsilon^* - 1]. \quad (18)
\]

Substituting into (18) for the definition of \(\Gamma\) gives the following expression for welfare in terms of \(\tau\) and \(t\):

\[
\tau \frac{dU^1}{d\tau} = \frac{\epsilon^*-1}{\Delta \Lambda} \left[ \eta - \left( \frac{t-1}{t} \right) \mu \right] M_1^1 [\bar{\tau}_{CU} - \tau], \quad (19)
\]

where

\[
\bar{\tau}_{CU} \equiv \bar{\tau}_{CU}(t, \tau^*) = \frac{\lambda^*}{e^* - 1} \quad \text{for} \quad \lambda \equiv \lambda(\tau, t, \tau^*) = \frac{\eta}{\eta - (\frac{t-1}{t}) \mu}.
\]

(Recall that \(\epsilon^*\) is the Marshallian price elasticity of ROW's import demand function defined in (15).) If \(\eta - \left( \frac{t-1}{t} \right) \mu\) and \(\epsilon^* > 1\), country 1's welfare will be increasing (decreasing) in \(\tau\) for \(\tau < \bar{\tau}_{CU}\) (\(\tau > \bar{\tau}_{CU}\)). With these conditions being satisfied \(\bar{\tau}_{CU}\) is the optimal external tariff of a customs union.
Note that with \( t = 1 \) and \( \lambda = 1 \) equation (19) reduces to the familiar elasticity formula for the optimal tariff (recall that \( \tau \) is one plus the tariff rate). The condition for \( \hat{\tau}_{CU} \) to be optimal in that case (i.e., \( \varepsilon^* > 1 \)) reflects the fact that a country would want to raise its tariff without limit as long as it is operating in the inelastic section of the foreign country’s offer curve. As can be seen from (18), the existence of internal trade barriers adds an additional requirement for \( \hat{\tau}_{CU} \) to be optimal. In order for the expression in (18) to be zero, we must have \( (\varepsilon^* - 1)\Gamma_{\tau} > 0 \) to generate a trade-off between the trade volume and the terms of trade effect at the optimum. If \( \varepsilon^* > 1 \) and \( \Gamma_{\tau} < 0 \), it will be desirable to raise the tariff for any initial \( \tau \) because of the magnitude of the internal tariff distortion. An increase in the external tariff \( \tau \) will generate a positive trade volume effect from intra-union trade as well as a favorable terms of trade effect on trade with ROW, which must raise welfare. The condition \( \eta < \left( \frac{t - 1}{t} \right) \mu \) in (19) guarantees that \( \Gamma_{\tau} > 0 \) at the optimum.

Assuming the conditions for \( \hat{\tau}_{CU} \) to be optimal are satisfied with \( t > 1 \), we will have \( \lambda > 1 \) if \( \mu > 0 \). In this case the external tariff is set more aggressively than suggested by the usual elasticity formula because increases in this tariff have the additional benefit of generating a favorable expansion of distorted internal trade. If \( \mu < 0 \), this effect is reversed.

One interesting question is how a customs union that sets its external tariff \( \tau \) optimally might adjust this tariff as it reduces its internal tariff \( t \). If the new external tariff exceeds the value associated with the requisite Kemp-Wan adjustment, ROW welfare will decrease along the path of optimal external tariff adjustments by the union. Since \( \varepsilon^* \) depends only on \( q \) and \( \tau^* \), it will be constant along the Kemp-Wan adjustment path. Thus, the question of how the optimal tariff will respond to internal tariff cuts depends on how \( \lambda \) varies along that path. Clearly this will depend on the specifics of the model chosen. In BSW (2001) we showed that \( \lambda = (t^\sigma + t)/(t^\sigma + 1) \geq \)
1 for \( t \geq 1 \) in the endowment model with CES consumer preferences. In this case, the \( \bar{\tau}_{CU}(t) \) locus will be flatter than the Kemp-Wan locus \( \tau_K(t) \) (notice that we suppressed the \( \tau^* \) argument since \( \tau^* \) is kept fixed in the background), indicating falling welfare for the non-member along the entire adjustment path, as long as \( \lambda_t > 0 \). This condition will hold for most parameter values, so that the loci will look as shown in Figure 1.

Figure 1 also illustrates two effects of customs union formation on the optimal tariff. First, the coordination of external tariffs by union members will result in a jump in the external tariff from \( N \) to \( C \) even before any internal liberalization takes place. Union members internalize the effects of their tariff on the partner country, and thus choose a higher common external tariff against on imports from ROW. The second effect is that even though the union reduces its external tariff along the path of internal liberalization to free trade, this reduction will be less than would be called for by the Kemp-Wan reduction. Thus, the outside country’s welfare will fall monotonically along the adjustment path in this case. Note further that this path would be monotonic even if there were a restriction that prevented the union from increasing its external tariff as a result of the formation of the union (as required, for example, by Article 24 of the GATT).

A similar question can be addressed for the case of FTAs if it is assumed that FTA members set their external tariff to maximize national (rather than FTA) welfare. In the case with \( \mu > 0 \), this will result in lower external tariffs because countries do not take into account the positive effect of their external tariff on the terms of trade of the partner country. In this case, the path of optimal tariffs will go through point \( N \) in Figure 1, which represents the initial Nash equilibrium. Unfortunately, the optimal tariff formulae for this case are quite complex and general results are not available. We showed in BRS (2004) that for the CES/endowment case, the change in the
FTA’s external tariff as a result of internal liberalization will be less than the Kemp-Wan adjustment. The favorable spillover of internal liberalization to ROW, as well as the fact that ROW will have an incentive to raise its external tariff, means that the member countries could actually lose from internal liberalization.

The possibility that $\mu < 0$ introduces a case that cannot arise with CES preferences. In this case a reduction in the internal tariff will shift demand toward the goods of imported from ROW, so that an increase in the external tariff is required to keep the non-member country’s welfare unaffected. If the PTA were constrained to follow the Article 24 requirement and maintain a constant external tariff, the welfare of the non-member would be improved. The welfare effect on the member countries would be ambiguous, since there is a worsening of the external terms of trade but an improvement in the internal trade volume.

Let us now suppose that the common external tariff remains fixed at a non-prohibitive level but the internal tariff is allowed to vary. To find the welfare effect of internal tariff changes, we note that $t \frac{dU^1}{dt} = q(\partial U^1 / \partial q)(\dot{q} / \dot{t}) + t(\partial U^1 / \partial t)$. Consider first the effect of an increase in $t$ in the neighborhood of internal free trade. If $\mu > 0$, this will have an unfavorable terms of trade effect of reducing $q$ from (16) but a favorable trade volume effect (for $\tau > 1$) of increasing trade with 3. If $\mu < 0$, an increase in $t$ will shift demand toward union goods, which is a favorable terms of trade effect, but will have an unfavorable trade volume effect. In each case there is a trade-off between a trade volume effect and a terms of trade effect from an increase in $t$. Substituting from (10) and (16) into this expression at $t = 1$ gives

$$t \frac{dU^1}{dt} = \frac{\mu (\varepsilon - 1) M^1}{A \Delta} \left[ \tau - \frac{\varepsilon}{\varepsilon - 1} \right]$$

(20)
If $\mu > 0$, the unfavorable terms of trade effect will dominate the trade volume effect as long as $\tau < \frac{e^*}{e^{*}-1}$ and welfare will be reduced when $t$ is increased. If $\mu < 0$, the favorable terms of trade effect dominates the unfavorable trade volume effect as long as $\tau < \frac{e^*}{e^{*}-1}$ and welfare will be increased if $t$ is raised instead. These features are illustrated in Figures 1 and 2. Note that, in either case, $\tau = \frac{e^*}{e^{*}-1} (= \tilde{\tau}_{CU}(t = 1))$ and $t = 1$ is the global optimum for the customs union.\(^6\)

A similar type of trade-off between terms of trade and trade volume effects can be conducted for the effects of tariff reductions for $t > 1$. Substituting from (20) we obtain for the general case

$$t \frac{dU_1}{dt} = \frac{M_2}{\Delta} [-\mu (1 + \Gamma_t) + \Gamma_t (e^* + \eta - 1)].$$

(21)

As long as $\text{sign} \, \Gamma_t = -\text{sign} \, \mu$, there will be a trade-off between terms of trade and trade volume effects. Since the signs of the terms in the welfare expression in (21) will remain unchanged in the neighborhood of $t = 1$, there will be an internal tariff $\tilde{\tau}_{CU} \equiv \tilde{\tau}_{CU}(\tau, \tau^*)$ that solves $dU_1/dt = 0$. However, care must be taken in deriving optimal tariff formulae because reversals are possible for large values of $t$.

Since the resulting expression is complicated we follow an indirect approach. Suppose there is an internal tariff $\tilde{\tau}_{CU}$ that solves $dU_1/dt = 0$ and assume that $\tilde{\tau}_{CU}$ monotonic in $\tau$. Instead of working with $\tau$ as the independent variable, we may consider the inverse of $\tilde{\tau}_{CU}$ and focus on $t$ as the independent variable instead. Specifically, define $\tau_{CU}(t, \tau^*) = \tilde{\tau}_{CU}^{-1}(\tau, \tau^*)$. We

\(^6\)We showed in BRS (2004) that this result will not hold in the case where the agreement takes the form of an FTA. In this case, FTA members reduce their external tariffs too much as the result of internal liberalization, so a positive internal tariff is desirable to encourage more aggressive setting of the external tariffs.
may now establish that

$$t \frac{du^1}{dt} = \frac{qM_{12}^1}{A\Delta} \left[ \varepsilon^* - 1 - (t - 1) \frac{qM_{11}^1}{M_3^1} \right] \left[ \tau - \bar{\tau}_{CU} \right]$$

(22)

where

$$\bar{\tau}_{CU} = \frac{t \varepsilon^* M_{22}^1 + (t-1)qM_{21}^1 |\varepsilon^* - 1 + \eta|}{M_{22}^1 |\varepsilon^* - 1 - (t-1) \frac{qM_{11}^1}{M_3^1}|}.$$ 

Although this expression is cumbersome, it does reveal that country 1’s welfare is increasing (decreasing) in the internal tariff \( t \) for \( \tau > \bar{\tau}_{CU} \) (\( \tau < \bar{\tau}_{CU} \)). Furthermore, if all goods are net substitutes we can show that country 1’s welfare falls when we consider tariff adjustments along \( \bar{\tau}_{CU} \) and away from the axis of external tariffs.

Lastly, let us form the ratio \( \rho(t, \varepsilon^*) \equiv \bar{\tau}_{CU}/\bar{\tau}_{CU} \). Differentiating this ratio with respect to \( t \) and evaluating the resulting expression at \( t = 1 \) readily implies \( \partial \rho(t = 1, \varepsilon^*)/\partial t > 0 \) when goods are net substitutes. This establishes the relative slopes of the loci illustrated in Figure 1.

It can also be shown that the welfare of PTA members must be increasing if the internal tariff is reduced and the external tariff is adjusted along the Kemp-Wan locus:

$$t \frac{du^1}{dt} \bigg|_{\tau=\tau_K(t)} = -\left( \frac{M_3^1(t-1)/t}{A \left( \eta + \frac{M_{11}^1 u_1}{A^2} \right)^2} \right) \left[ \mu^2 - \frac{(ta)^2 M_{22}^1 \eta}{M_3^1} \right].$$

(23)

The bracketed expression must be positive because the compensated own substitution effect is negative. As long as the denominator of (23) is positive (which is a condition that requires an increase in \( \tau \) to improve the member’s terms of trade), this establishes that welfare of the
representative CU member is decreasing in $t$ along the Kemp-Wan tariff adjustment locus. Furthermore, (23) shows that at $t = 1$, member welfare will be at a maximized along the Kemp-Wan tariff adjustment locus. This is reflected by the tangency between iso-welfare contours of the member and the $\tau_K$ locus at $t = 1$ in Figures 1 and 2. Note also that, if country 1's importables are net substitutes, the schedule of the optimal internal tariff as a function of the external tariff (i.e., $\tilde{t}_{CU}$) will cross the $\tau$-axis as indicated in Figure 1. In this case, for given external tariffs, the optimal internal intervention entails imports tariffs when $\tau > \frac{\varepsilon^*}{\varepsilon^{*-1}}$ and import subsidies when $\tau < \frac{\varepsilon^*}{\varepsilon^{*-1}}$. Exactly the opposite would be true if country 1's importables were net complements.

5. Conclusion

One of our objectives in this paper has been to examine the impact of internal trade liberalization on tariffs and welfare of member countries in a PTA and the rest of the world in a general three-good environment where the member countries are symmetric. A related second objective has been to compare the results obtained to those that arise in the more restricted pure endowment model with CES preferences. We view this as worthwhile endeavors because they highlight the costs and benefits of using specific functional forms.

A key component of our analysis has been the description and characterization of Kemp-Wan tariff schedules (i.e., schedules that indicate how much the PTA’s external tariff must be adjusted in response to internal trade liberalization in order to maintain the welfare of the rest of the world at its initial level). Our analysis revealed that, in the case where union and non-union exports are net substitutes, a Kemp-Wan adjustment to internal tariff cuts calls for a reduction of
the external tariff in the neighborhood of internal free trade. A sufficient condition for this result to hold with positive internal barriers is that the sign of the trade volume effects not be reversed from their value at $t = 1$. We were also able to derive a simple formula characterizing the optimal tariff for the customs union as a function of the internal tariff.

Our findings indicate that in the case where union and non-union goods are net substitutes, the characteristics of the welfare contours in the general case are similar to those for the CES case in the neighborhood of $t = 1$. Thus, qualitatively there is little loss of generality in considering models with specific functional forms in this region. However, for $t > 1$ the general model allows for paradoxes (e.g., reversals of the slope of the Kemp-Wan locus) that do not arise in the CES/endowment model. The CES/endowment model establishes that, as internal tariffs are reduced, welfare of the outside country will fall when a customs union adjusts its external tariff optimally. Although this result is specific to this model, the optimal tariff formula indicates how this comparison can be made for the general case.

Specific functional forms are also needed to obtain results on the strategic analysis of FTAs, where the optimal tariff formulae are more complex. These results also suggest that strategic analysis that includes ROW tariffs requires either the adoption of specific functional forms or the imposition of plausible restrictions on how price elasticities vary with tariff levels in order to obtain more definitive results (as in Syropoulos (2002)).

In contrast to the CES/endowment model, the more general model allows for a case in which there is complementarity between the traded goods of PTA members and non-members. In this case, internal liberalization by the union will benefit the rest of the world at fixed external tariffs, so a Kemp-Wan adjustment calls for an increase in the external tariff of the union.

These results also suggest the desirability of extending the analysis to consider the other
trade pattern consistent with this symmetric model, which is one in which each country imports a good from the other two countries. This introduces the possibility of explicit tariff discrimination.
References


Figure 1