

Multilateral tariff cooperation during the formation of customs unions

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Abstract

We study the implications of customs-union formation for multilateral tariff cooperation. We model cooperation in multilateral trade policy as self-enforcing, in that it involves balancing the current gains from deviating unilaterally from an agreed-upon trade policy against the future losses from forfeiting the benefits of multilateral cooperation that such a unilateral defection would imply. The early stages of the process of customs-union formation are shown to alter this dynamic incentive constraint in a way that leads to a temporary “honeymoon” for liberal multilateral trade policies. We find, however, that the harmony between customs unions and multilateral liberalization is temporary: eventually, as the full impact of the emerging customs union becomes felt, a less favorable balance between current and future conditions re-emerges, and the liberal multilateral policies of the honeymoon phase cannot be sustained.

Key words: Customs unions; Preferential agreements; The Multilateral Trading System

1. Introduction

Recently, there has been renewed interest in regional trade agreements as countries turn with increasing frequency to regional options regarding trade policy. The continued integration of the European Community (EC) embodied in EC92,

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and the integration of North America beginning with the US–Canada Free Trade Agreement and continuing with the addition of Mexico under the North American Free Trade Agreement (NAFTA), are but the most prominent examples of regional approaches to trade liberalization that have come about over the last decade. Much of the interest in the effects of such agreements reflects a growing concern that their recent proliferation, with the United States in particular now actively engaged in the pursuit of regional trade agreements, could serve to undermine multilateral cooperation under the General Agreement on Tariffs and Trade (GATT) and its successor, the World Trade Organization (WTO).

The view that regionalism might be antithetical to multilateral cooperation is new and somewhat ironic, as the previous experience with the formation and extension of the EC seems to suggest just the opposite interpretation. For example, the EC was formed among its six original members in 1957 and phased in over the ensuing decade, and the prospect of an integrated EC market appears to have been a major stimulus to the successful Kennedy Round of multilateral negotiations under GATT initiated in 1964. Impetus for the Tokyo Round of multilateral GATT negotiations initiated in 1973 can be similarly linked in part to the EC enlargement to include the United Kingdom and other countries. Indeed, Bhagwati (1991) has observed that the perception surrounding these experiences was of general compatibility between regional agreements and multilateral cooperation through GATT negotiations.¹

Given the recent spate of regional agreements, and the evolving views regarding their implications for multilateral cooperation, it is important to set out formal models that explore the impact of regional agreements for multilateral cooperation. We present such a model here in the context of regional customs unions, and offer the prediction that the relationship between customs-union formation and multilateral tariff cooperation is non-stationary. In particular, we argue that the early experience with the formation of customs unions and their effects on multilateral tariff cooperation may be a poor guide to the impact that their formation has on sustainable multilateral tariff cooperation in the long run. On the contrary, our model suggests that the early phases of customs-union formation will be associated with a temporary “honeymoon” for multilateral trade policies that cannot be sustained.

We adopt the view, as in Dam (1970) and Bagwell and Staiger (1990), that (i) enforcement issues are central to an understanding of the dynamic behavior of trade intervention in a world where countries attempt to maintain cooperative trade policies, and (ii) in practice, the enforcement of agreed-upon behavior under

¹On the link between the formation of the EC and the Kennedy Round, see for instance the remarks made by former Secretary of State Christian Herter (1961) before the Joint Economic Committee. For a broader review of the historical links between multilateral liberalization and the formation of the EC and its subsequent enlargement, and for a reassertion of the complementary relationship between regional integration and multilateral liberalization, see WTO (1995, pp. 53–56).

GATT is limited by the severity of retaliation that can be credibly threatened against an offender by its trading partners. Specifically, we view cooperation in multilateral trade policy as involving a delicate balance between, on the one hand, gains from deviating unilaterally from an agreed-upon trade policy, and on the other, the discounted expected future benefits of maintaining multilateral cooperation, with the understanding that the latter would be forfeited in the trade war which followed a unilateral defection in pursuit of the former. In such a setting, changes in current conditions or in expected future conditions can upset this balance, requiring changes in existing trade policy that will bring incentives back into line. We explore here the sense in which the formation of regional trade agreements upsets the balance between current and future conditions, and trace through the dynamic ramifications of these effects for multilateral cooperation.

A crucial focus of our analysis is the period of *transition*, during which the regional agreement is being implemented. Both because regional trade agreements involve a lengthy staging period (typically a decade or longer) during which tariff changes are implemented, and because trade patterns take time to reflect changes in trade barriers in any event, there will inevitably be a substantial lag between the signing of a regional trade agreement and the changes in trading relationships that it eventually brings about. This lag creates a period of transition within which, at least initially, the important changes are with regard to expected future trading relationships rather than current conditions. It is this basic observation that is central to our results.

To understand our main findings, it is helpful first to categorize two of the principal effects of a regional agreement. A first consequence of such an agreement is the *trade diversion effect*, whereby the removal of internal tariffs between member countries acts to enlarge intra-member trade volume and reduce the volume of trade between member and non-member countries. A second effect is the *market power effect*. While the trade diversion effect arises for both free trade agreements and customs unions, the market power effect is particular to the formation of customs unions: under a customs union, the member countries adopt a common external tariff on imports, and this in turn enables them credibly to impose a higher import tariff on their multilateral trading partners than if their external tariff were not harmonized, should such a punitive tariff be desired.

In a separate paper (Bagwell and Staiger, 1997), we argue that the trade diverting effect of free trade agreements leads to higher multilateral tariffs during the transition period over which such agreements are negotiated and implemented. Intuitively, during the period of transition, trade volume between member and non-member countries is still large, as internal tariffs between member countries have not yet been eliminated. Yet, member and non-member countries recognize that they will trade less with one another in the future, once the agreements are implemented. Thus, during the transition phase, the incentive to deviate unilaterally is large as compared with the now smaller discounted future value of maintaining a cooperative relationship. To ensure some measure of cooperation

between member and non-member countries it is then necessary to raise the transition-period tariffs between the two sets of countries, reducing the volume of their trade and the associated incentive to defect.

In the present paper, we consider the formation of customs unions. While generally both trade diversion and market power effects will be associated with customs-union formation, we provide a model in which the market power effect is isolated. In this setting, we show that the emergence of customs unions will be associated with temporarily reduced multilateral trade tensions between member and non-member countries, and consequently, with a temporary honeymoon for liberal multilateral trade policies. This easing of tensions arises during the period of transition, when the current degree of market power possessed by each member country (and hence the current incentive to deviate unilaterally) is more or less unchanged at the same time that the expected future degree of market power possessed by each member country (and hence the value to non-member countries of maintaining future multilateral cooperation) has increased. Intuitively, under such conditions, non-member countries are less apt to take a confrontational stance in trade disputes with member countries of the emerging customs union, as the risk of a possible trade war with such countries now poses a greater deterrent to confrontation than it once did. Our results suggest, however, that the harmony between customs unions and multilateral liberalization is temporary: eventually, as the impact of the emerging customs union on the degree of market power becomes felt, a less favorable balance between current and expected future conditions re-emerges, and liberal multilateral trade policies cannot be sustained.

While the economic and political determinants of regional agreements and multilateral cooperation certainly extend beyond the reach of any one model, our model does provide a novel perspective on the EC experience. Specifically, the original EC customs-union formation and its subsequent enlargement may have contributed to a honeymoon period for GATT negotiations, over which the market power effect associated with customs-union development made possible further multilateral tariff liberalization. Viewed in this light, recent concerns regarding the compatibility of multilateral tariff cooperation and regional agreements may in part reflect the passing of this honeymoon period and the consequent heightening of multilateral trade tensions.

Our work relates to a broad literature. The economics of customs unions has formed a central arm of the study of international commercial policy since Viner (1950)'s classic treatment of the subject. Viner stressed the trade-creating and trade-diverting consequences of customs-union formation, concluding that world welfare need not rise when customs unions are formed. The welfare consequences of customs unions have since been further explored by Bond and Syropoulos (1996a), Deardorff and Stern (1994), Kemp and Wan (1976) and Krugman (1991), among others. A second set of work shares the focus of this paper and examines the impact on multilateral tariff cooperation of regional agreements. Papers in this category include Kowalczyk (1990), Kowalczyk and Sjostrom (1994), Kowalczyk

and Wonnacott (1991) and Ludema (1992), who explore how multilateral bargains can be altered by the opportunity to make regional deals, as well as Levy (1997), who examines the sense in which regional options undermine political support for multilateral liberalization.² These papers point to interesting issues, but they also assume that binding commitments can be made to enforce the international bargaining outcome. By contrast, our theory is driven by the tradeoffs associated with the construction of self-enforcing agreements. The focus on self-enforcing agreements seems particularly appropriate for international agreements, such as GATT, since it is not clear how binding commitments could be enforced.³

The paper is organized as follows. The next section sets out the basic model within which we will study the formation of customs unions, and establishes several properties in a stationary setting that will be useful in the dynamic non-stationary analysis to follow. Section 3 then characterizes the dynamic behavior of equilibrium multilateral tariffs in the non-stationary environment of emerging customs unions. Section 4 derives various comparative statics results. Finally, Section 5 concludes and discusses the implications of our results for the design of GATT Article XXIV, which specifies the conditions under which customs unions may be formed.

2. Multilateral tariff determination in stationary environments

In this section we develop and explore the properties of a stationary model of multilateral tariff formation in the presence of customs unions. In the next section we will describe the non-stationarities that arise when the process of customs-union formation is explicitly considered.

2.1. A static customs-union model

To direct attention to the main effects, we analyze a simple, partial-equilibrium exchange economy. There are two types of countries, “foreign” countries denoted by a “*”, of which there are a total of K , and “domestic” countries denoted by the absence of a “*”, of which there are also K . The K foreign countries are

²Amdt (1969) was apparently the first to attempt to formalize the effect of customs-union formation on the tariffs of non-member countries, concluding that: “An interesting by-product of the foregoing analysis is the suggestion that optimum tariff strategy may dictate that some countries remaining outside the union reduce their prevailing tariffs. Much depends upon the extent of tariff warfare prior to formation of the union, and upon the dynamics of tariff competition about which very little is known. It is nevertheless intriguing to speculate about the extent to which the existence of the European Economic Community facilitated the Kennedy Round” (p. 117).

³A paper written independently of ours which shares our focus on self-enforcing agreements is Bond and Syropoulos (1996b). They consider a stationary environment, and compare cooperative multilateral tariffs across equilibria with blocs of different sizes.

grouped symmetrically into R foreign customs unions or *foreign regions*, while the K domestic countries are similarly grouped symmetrically into R *domestic regions*.⁴ Thus, $k \equiv K/R$ gives the number of member countries per region. With this framework, we can investigate the consequences of customs unions for multilateral tariffs by varying the number of regions, R , while holding fixed the total number of countries, K .

There are only two goods, referred to as the domestic and the foreign export goods, respectively, and there exist two units of each good in total in the world. Each domestic country is endowed with $2/K$ units of the domestic export good and none of the foreign export good, while each foreign country is endowed with $2/K$ units of the foreign export good and none of the domestic export good. On the demand side, we suppose that each country j has linear demand for good i of

$$C(P_j^i) = \frac{1}{K}[\alpha - \beta P_j^i]; C(P_j^{i*}) = \frac{1}{K}[\alpha - \beta P_j^{i*}] \quad (1)$$

where P_j^i is the price of good i in domestic country j , and P_j^{i*} is the price of good i in foreign country j .

We note that our assumptions on endowments and demands imply that domestic countries do not trade with each other, and likewise that foreign countries do not trade with each other. Thus, customs-union formation among domestic countries and among foreign countries entails no trade diversion, but occurs rather among competing suppliers of a common export good, and competing demanders of a common import product. This property of the model allows us to abstract from trade diversion/trade creation issues that are common to both free trade areas and customs unions so that we may highlight the market power effect associated with the harmonization of external tariffs that is unique to customs-union formation.⁵

We now proceed to characterize static equilibrium import tariff choices. Recalling that a common import tariff is selected by all members of a customs union or region, we may let τ_r represent the (specific) import tariff levied by domestic region r , and τ_r^* represent the import tariff levied by foreign region r , where $r = 1, \dots, R$. Given the endowment structure described above, we also may simplify the notation and define prices as follows: P_{xr} (P_{xr}^*) is the price in domestic

⁴We discuss the generalization of our results to asymmetric cases in our working paper (Bagwell and Staiger, 1993).

⁵Our partial equilibrium model can be closed with the addition of a traded numeraire good z under the assumption that utility of the representative agent is given by $U = C_z + \sum_{i=1}^2 [(\alpha/\beta)C_i - (1/2\beta)(C_i)^2]$ with C_z denoting consumption of the numeraire good z and C_i denoting consumption of good $i = 1, 2$. Provided that z is sufficiently abundant in each country so that it is always consumed in positive amounts by each agent, the marginal utility of income will be fixed at one and partial equilibrium analysis of the non-numeraire sectors is appropriate. Trade in the numeraire good will then be determined by the requirement of overall trade balance.

(foreign) region r of the good that r exports, and P_{mr} (P_{mr}^*) is the price in domestic (foreign) region r of the good that r imports. Since import taxes are assumed not to discriminate across sources, the domestic export good will face the same constellation of import tariffs regardless of the good's region of origin, and similarly for the foreign export good. Thus, since regions are otherwise symmetric, each export good will have a single price in all exporting regions, and so we may remove the r subscript and let P_x (P_x^*) denote the domestic (foreign) export good's price in any export region. Of course, import prices may differ across regions, as different regions may select different import tariffs.

Now, for any domestic region r , we have $P_{mr} = P_x^* + \tau_r$, provided τ_r is non-prohibitive. This, together with the world market clearing condition for the foreign export good, $2 = \alpha - \beta P_x^* + \sum_{\ell=1}^R (1/R)(\alpha - \beta P_{m\ell})$, gives the equilibrium prices, $\hat{P}_x^*(R, \bar{\tau})$ and $\hat{P}_{mr}(R, \bar{\tau})$, and per-region import quantities, $\hat{M}_r(R, \bar{\tau}) \equiv kC(\hat{P}_{mr}) = (1/R)(\alpha - \beta \hat{P}_{mr})$, for the foreign export good, when it faces the vector of domestic import tariffs $\bar{\tau} \equiv (\tau_1, \dots, \tau_R)$. These solutions are:

$$\hat{P}_x^*(R, \bar{\tau}) = \frac{\alpha - 1}{\beta} - \frac{1}{2R} \sum_{\ell=1}^R \tau_{\ell}; \quad \hat{P}_{mr}(R, \bar{\tau}) = \frac{\alpha - 1}{\beta} - \frac{1}{2R} \sum_{\ell=1}^R \tau_{\ell} + \tau_r \quad (2)$$

$$\hat{M}_r(R, \bar{\tau}) = \frac{1}{R} - \frac{\beta}{R} \left[\tau_r - \frac{1}{2R} \sum_{\ell=1}^R \tau_{\ell} \right]. \quad (3)$$

The symmetric structure of the model assures that equilibrium prices and per-region import quantities for the domestic export good are given by expressions exactly analogous to Eq. (2) and Eq. (3) with the vector of foreign import tariffs $\bar{\tau}^* \equiv (\tau_1^*, \dots, \tau_R^*)$ replacing $\bar{\tau}$.

With Eq. (2) and Eq. (3) in place, we can define regional welfare per member country. Specifically, a domestic country's welfare when domestic and foreign regions respectively select import tariffs $\bar{\tau} \equiv (\tau_1, \dots, \tau_R)$ and $\bar{\tau}^* \equiv (\tau_1^*, \dots, \tau_R^*)$ is given by

$$W(R, \bar{\tau}, \bar{\tau}^*) = \int_{\hat{P}_{mr}(R, \bar{\tau})}^{\alpha/\beta} C(P) dP + \int_{\hat{P}_x(R, \bar{\tau}^*)}^{\alpha/\beta} C(P) dP + \int_0^{\hat{P}_x(R, \bar{\tau})} (2/K) dP + \tau_r [R/K] \hat{M}_r(R, \bar{\tau}) \quad (4)$$

which corresponds to the consumer surplus received on the foreign export good, the consumer surplus received on the domestic export good, the producer surplus received on the domestic export good, and the tariff revenue received on the

foreign export good, respectively, when r is the domestic region to which the country belongs. Welfare is defined symmetrically for any foreign country.⁶

The main features of W are summarized as follows. First, W is maximized at the regional tariff choice

$$\tau_r^D(R, \sum_{\substack{\ell=1 \\ \ell \neq r}}^R \tau_\ell) = \frac{2R}{\beta(4R^2 - 1)} + \frac{1}{(4R^2 - 1)} \sum_{\substack{\ell=1 \\ \ell \neq r}}^R \tau_\ell \quad (5)$$

which is the best “defect” tariff for a country in domestic region r – and equivalently for the domestic region r to which the country belongs – when other domestic regions select import tariffs τ_ℓ , where $\ell \neq r$. Thus, the optimal tariff is positive, and it is also independent of the tariff levels selected by trading partners (namely *foreign* regions). The latter property is a consequence of our assumptions that demands are independent across goods and that export taxes are not possible.

Second, notice from Eq. (5) that the optimal tariff for the domestic region r is increasing in the tariffs selected by other *domestic* regions. Intuitively, this is because the respective domestic regions “compete” for imports: when other domestic regions raise their import tariffs, additional import volume is released for domestic region r , and this increases the incentive for region r to raise its own tariff and receive even greater tariff revenue.

Third, an interesting pattern of externalities is apparent. Examination of Eq. (4) reveals that an increase in a foreign-region tariff reduces the welfare of any domestic country, as the domestic country then receives lower producer surplus. On the other hand, there is a *positive* externality between similarly-endowed countries: as a domestic region raises its tariff, more import volume is directed to other domestic regions, and the countries in these regions experience a welfare gain. When domestic and foreign regions all select the same tariff, however, the former effect dominates, in that each country’s welfare increases as the symmetric tariff is reduced.

Finally, let us now define the *static tariff game* to be the game in which each region simultaneously selects an (external) import tariff in order to maximize its

⁶The essential feature of our static model is its prisoners’ dilemma property. It is important to emphasize that this property is robust to inclusion of domestic political economy influences. Following Baldwin (1987), political influences can be represented with a parameter that attaches additional weight to producer surplus in the government welfare function. As this parameter affects government preferences as to the distribution of surplus within the domestic economy, the efficient trade policy is also affected by domestic political economy pressures. It remains true, however, that countries face a prisoners’ dilemma problem in their dealings with one another: the efficient trade policy that maximizes joint welfare is not a Nash equilibrium, since each country does even better when it unilaterally exploits the terms-of-trade consequences of its policy choices and thereby redistributes surplus from its trading partner to itself. The inclusion of a political economy parameter therefore amounts to a renormalization of the traditional framework, changing only the level of the efficient tariff to which countries aspire and not the basic terms-of-trade incentives that frustrate the pursuit of this objective. See Bagwell and Staiger (1996) for further elaboration on these points.

welfare per member country. Calculations reveal that the symmetric Nash equilibrium for the static tariff game occurs when all regions select the positive import tariff:

$$\hat{\tau}^N(R) = \frac{2}{\beta(4R - 1)}. \quad (6)$$

This expression exposes the “market power effect” of customs-union formation: when customs unions expand in the sense of being fewer in number and larger in size (i.e. as R decreases), the newly-joined similarly-endowed countries internalize their joint incentive for higher import-tariffs, and consequently the Nash tariff rises.⁷

2.2. A stationary dynamic customs-union model

We now explore the possibility that the R domestic and R foreign regions can achieve greater efficiency through a multilateral trade agreement that calls for reciprocal trade liberalization below the Nash tariff level and that is self-enforcing. To this end, we consider a *stationary dynamic tariff game*, which is defined by the infinite repetition of the static tariff game described above. In each period the regions observe all previous import tariff selections and simultaneously choose import tariffs. For the reasons given above, we continue to assume that each region applies the same tariff to imported goods from all sources in any given period. The game is stationary in the sense that none of the model’s parameters changes through time. Let $\delta \in (0,1)$ denote the discount factor between periods.

In order to express our ideas in a simple manner, we focus on a particular class of subgame perfect equilibria for the stationary dynamic tariff game. Specifically, we consider equilibria in which (i) symmetric stationary non-negative import tariffs are selected along the equilibrium path, meaning that in equilibrium all regions select the same import tariff in each period, and (ii) if a deviation from this common tariff occurs, then in the next period and forever thereafter the regions revert to the Nash equilibrium tariffs of the static tariff game. We then refer to the *most-cooperative equilibrium* of the stationary dynamic tariff game as the subgame perfect equilibrium which yields the lowest possible equilibrium tariff

⁷The finding that static Nash tariffs increase with customs-union formation is a robust implication of the market power effect of customs-union formation that we have isolated in this model, but it can be overturned in certain circumstances with the introduction of sufficient trade diversion. (See Krugman (1991) for a model of customs-union formation with both market power and trade diverting effects, in which customs-union formation leads to higher static Nash tariffs, and Bond and Syropoulos (1996a) for an example of how trade diverting effects can overturn this result.) We return in the concluding section to discuss more broadly the sensitivity of our results to the relative strengths of the market power and trade diversion effects associated with the formation of customs unions.

while satisfying restrictions (i) and (ii). The corresponding import tariff is then termed the *most-cooperative tariff* for the stationary dynamic tariff game.⁸

In a dynamic model, regions have the possibility of supporting a cooperative tariff, τ^c with $\tau^c < \hat{\tau}^N(R)$, since any attempt to raise the current-period tariff will be greeted with retaliatory (Nash) tariffs from other regions in future periods. Intuitively, a cooperative tariff τ^c can then be supported in an equilibrium for the stationary dynamic tariff game if the one-time incentive to cheat is sufficiently small relative to the future value of maintaining a cooperative relationship among trading regions.

To formalize this intuition, let us first examine the incentive a region has to cheat. For a fixed cooperative tariff $\tau^c < \hat{\tau}^N(R)$, and given the class of subgame perfect equilibria upon which we focus, if a region is to deviate and select a tariff other than τ^c , then it will deviate to its best-response tariff, as defined in Eq. (5). We now simplify the notation slightly and use $\tau^D(R, \tau^c)$ to represent the best-response tariff for a given region when all other same-type regions are selecting the cooperative tariff, τ^c . The per-member-country gain when the associated region cheats is then given by:

$$\Omega(R, \tau^c) \equiv W(R, (\tau^D, \bar{\tau}^c); \bar{\tau}^c) - W(R, \bar{\tau}^c, \bar{\tau}^c), \quad (7)$$

where τ^c is a scalar and $\bar{\tau}^c$ is a vector in which the scalar τ^c is present in each component.⁹ Intuitively, Ω is the difference between (i) the per-member-country welfare when the region to which the country belongs selects the best-defect tariff while all other regions – domestic and foreign – continue to select the cooperative tariff τ^c , and (ii) the per-member-country welfare when the country's region cooperates in choosing the same cooperative tariff as do all other regions.

When a region cheats, however, it also causes future welfare to drop, and we now examine this cost of cheating. Define the one-period value to cooperation per member country to be:

$$\omega(R, \tau^c) \equiv W(R, \bar{\tau}^c; \bar{\tau}^c) - W(R, \bar{\tau}^N(R); \bar{\tau}^N(R)). \quad (8)$$

where $\bar{\tau}^N(R)$ is an R -dimensional vector in which the scalar $\hat{\tau}^N(R)$ as defined in

⁸We could consider other forms of symmetric punishment, some of which would allow for greater levels of cooperation than the infinite Nash reversion considered here. However, the qualitative nature of our dynamic results concerning the behavior of cooperative tariffs is unlikely to be affected. Moreover, infinite reversion is not an entirely implausible representation of actual tariff wars: the high US tariffs on imports of light-duty trucks imposed as a result of the "chicken war" with the EC in 1963, for example, are still in place 30 years later. Our restriction to *symmetric* punishments, however, could be more substantive as we discuss in our discussion paper (Bagwell and Staiger, 1993).

⁹The notation in Eq. (7) is slightly awkward: $\bar{\tau}^c$ is an R -dimensional vector in each appearance, except for when $(\tau^D, \bar{\tau}^c)$ is written, in which case $\bar{\tau}^c$ is an $R - 1$ -dimensional vector. This latter case is meant to symbolize that the domestic region of interest defects to τ^D while all other domestic regions continue to each select the tariff τ^c .

Eq. (6) is present in each component. Then the cost to cheating is $\delta/(1-\delta) \cdot \omega(R, \tau^c)$, since once a region defects and selects a high import tariff, cooperative tariffs are thereafter replaced by the higher Nash tariffs.

Using Eq. (7) and Eq. (8), the fundamental “no-defect” condition is that the benefit of cheating be less than the discounted future value of cooperation, or:

$$\Omega(R, \tau^c) \leq \frac{\delta}{1-\delta} \omega(R, \tau^c). \quad (9)$$

Any cooperative tariff τ^c that satisfies Eq. (9) can be supported in a subgame perfect equilibrium of the stationary dynamic tariff game.

Our interest lies in the most-cooperative tariff $\hat{\tau}^c$, which is the smallest non-negative tariff that satisfies Eq. (9). To characterize this tariff, we first investigate the properties of $\Omega(R, \tau^c)$ and $(\delta/(1-\delta))\omega(R, \tau^c)$. Calculations reveal that:

$$\Omega(R, \tau^c) = \frac{\beta(4R-1)^2}{8K(4R^2-1)} [\hat{\tau}^N(R) - \tau^c]^2. \quad (10)$$

Using Eq. (10), it follows that:

$$\frac{\partial \Omega(R, \tau^c)}{\partial R} < 0 \text{ if } \tau^c < \hat{\tau}^N(R) \quad (11)$$

$$\frac{\partial \Omega(R, \tau^c)}{\partial \tau^c} < 0 \text{ and } \frac{\partial^2 \Omega(R, \tau^c)}{\partial \tau^{c2}} > 0 \text{ if } \tau^c < \hat{\tau}^N(R). \quad (12)$$

Thus, a decrease in R , which corresponds to more concentrated customs-union formation, acts to raise the benefit from defection, since a given customs union has greater power to affect world prices with its tariff increase. Notice also that lower cooperative tariffs heighten the incentive to cheat, because a deviation then represents a more significant tariff increase.

Calculations also reveal that:

$$\frac{\delta}{1-\delta} \omega(R, \tau^c) = \frac{\delta}{1-\delta} \frac{\beta}{4K} [(\hat{\tau}^N(R))^2 - (\tau^c)^2] > 0 \text{ if } \tau^c < \hat{\tau}^N(R). \quad (13)$$

Using Eq. (13), it follows that:

$$\frac{\partial}{\partial R} \left(\frac{\delta}{1-\delta} \omega(R, \tau^c) \right) < 0 \text{ if } \tau^c < \hat{\tau}^N(R) \quad (14)$$

$$\frac{\partial}{\partial \tau^c} \left(\frac{\delta}{1-\delta} \omega(R, \tau^c) \right) < 0 \text{ and } \frac{\partial^2}{\partial \tau^{c2}} \left(\frac{\delta}{1-\delta} \omega(R, \tau^c) \right) < 0 \text{ if } \tau^c > 0. \quad (15)$$

Thus, as R falls and customs unions become fewer in number and larger in size, the non-cooperative Nash tariff rises and so the cost of a trade war grows.

However, higher cooperative tariffs lower the discounted value of future cooperation.

The determination of the most-cooperative tariff is now easily illustrated by Fig. 1. Observe in Fig. 1 that the no-defect condition (Eq. (9)) is satisfied for all $\tau^c \in [\hat{\tau}_s^c(R), \hat{\tau}^N(R)]$. These are the tariffs that are supportable as subgame perfect equilibrium tariffs for our stationary dynamic tariff game, given the class of equilibria upon which we focus. Solving Eq. (9) for the tariff that gives equality yields the most-cooperative tariff, which is given by:

$$\hat{\tau}_s^c(R) = \hat{\tau}^N(R) \left\{ \frac{(4R - 1)^2(1 - \delta) - 2\delta(4R^2 - 1)}{(4R - 1)^2(1 - \delta) + 2\delta(4R^2 - 1)} \right\}. \quad (16)$$

Two observations can be made about the equilibrium most-cooperative tariff in the stationary dynamic game. First, note that $\hat{\tau}_s^c(R)$ is decreasing in δ , with $\hat{\tau}_s^c = 0$ at

$$\delta = \frac{(4R - 1)^2}{2(4R^2 - 1) + (4R - 1)^2} \equiv \delta^*(R).$$

This decreasing relationship is intuitive: as δ increases, the discounted value of future cooperation is enhanced, and so a lower tariff can be supported (despite the

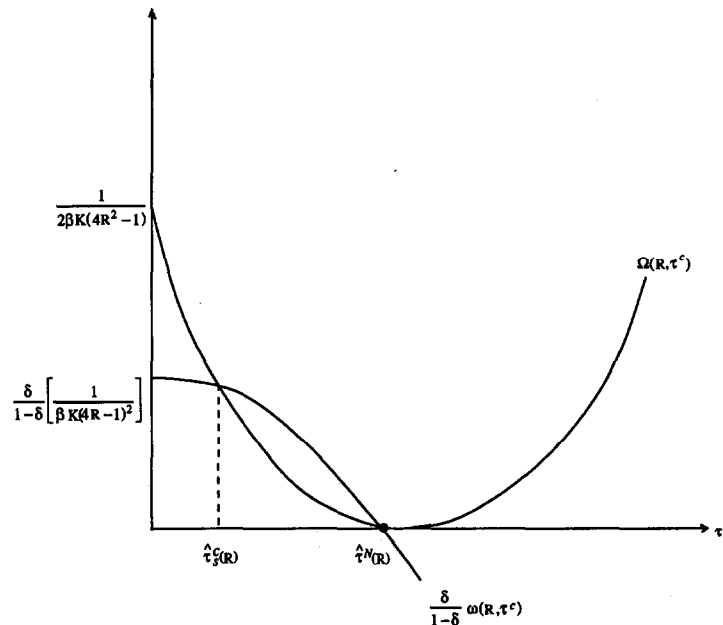


Fig. 1. Determining the most-cooperative stationary tariff.

consequent greater incentive to cheat). To avoid cases in which the most-cooperative tariff corresponds to either of the extreme polar outcomes of free trade or the non-cooperative tariff $\hat{\tau}^N(R)$, we assume in what follows that $\delta \in (0, \delta^*(R))$ for all R that we consider.

Second, whether or not the existence of smaller numbers of larger customs unions is good or bad for multilateral tariff cooperation between regions in the stationary dynamic game depends on the discount factor δ . This makes sense, since the market power effect associated with customs-union formation (a falling R) makes higher tariffs more attractive and thus increases both the onetime benefit from cheating ($\Omega(R, \tau^c)$ – see Eq. (11)) and the cost of a tariff war ($(\delta/(1 - \delta))\omega(R, \tau^c)$ – see Eq. (14)). If countries do not weigh the future too heavily, then the effect of customs-union formation on the one-time benefit from cheating dominates its effect on the cost of a tariff war, and the most-cooperative stationary tariff must be raised to keep the incentive constraint in check. In the limit, when $\delta = 0$, the most-cooperative tariff is simply $\hat{\tau}^N(R)$, which by Eq. (6) is declining in R . On the other hand, for δ sufficiently high, customs-union formation may be good for multilateral tariff cooperation in the stationary dynamic game, as the effects of customs-union formation on the added benefits from cheating become overwhelmed by the added cost of a tariff war. In the limit, as δ approaches $\delta(R)$, customs-union formation must be good for multilateral cooperation, since $\delta(R)$ is increasing in R ; i.e. customs-union formation lowers the discount factor at which free trade is sustainable.

The dependence of the most-cooperative stationary tariff on the discount factor is illustrated in Fig. 2, where customs-union expansion corresponds to a reduction in the number of customs unions from R_0 to R_1 , where $R_0 > R_1$. As the figure indicates, when countries do not weigh the future heavily, customs-union expansion results in a higher most-cooperative stationary tariff; but, when the discount factor is large, customs-union expansion is reflected in a lower most-cooperative stationary tariff. It follows that a critical discount factor, $\tilde{\delta}(R_0, R_1)$, must exist at which the most-cooperative stationary tariff is neutral with respect to customs-union expansion, and below which customs-union expansion results in a higher most-cooperative stationary tariff.¹⁰

In what follows we assume $\delta < \tilde{\delta}(R_0, R_1)$ so that customs-union formation is bad for multilateral cooperation in the stationary dynamic game. We choose to do this for several reasons. First, for simple cases of customs-union formation, this captures most of the relevant range of discount factors.¹¹ For example, in the case

¹⁰ Fig. 2 has been drawn to illustrate the case in which there is a unique δ under which the most-cooperative stationary tariff is neutral with respect to customs-union expansion. If more than one such δ exists over the relevant range – and there could be at most two – then we define $\tilde{\delta}(R_0, R_1)$ as the smallest such δ .

¹¹In a related context to our stationary dynamic environment, Bond and Syropoulos (1996b) argue that this is the relevant case as well.

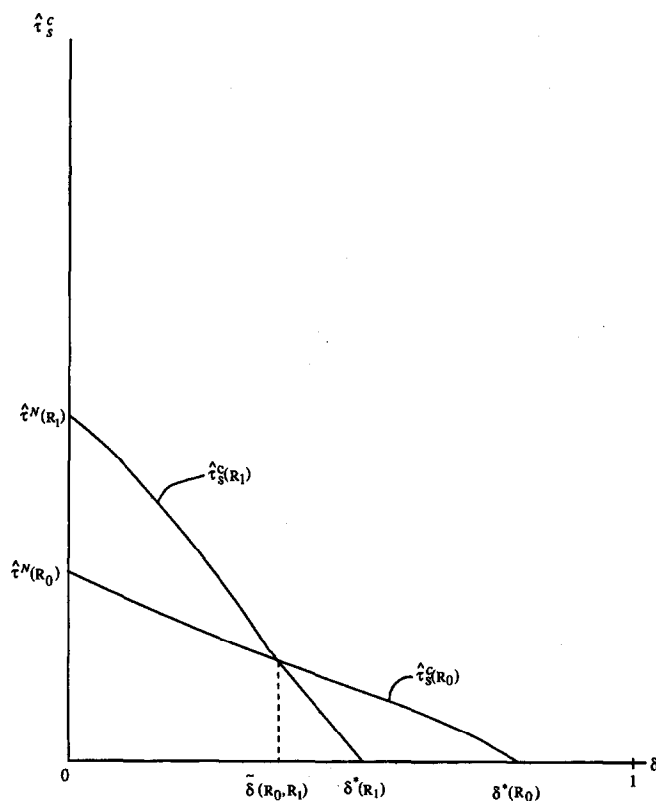


Fig. 2. Customs-union expansion and the most-cooperative stationary tariff for different discount factors.

where customs-union formation takes R from $R_0 = 2$ to $R_1 = 1$, we require that $\delta < \delta(R_1) = 0.60$ to ensure that free trade cannot be sustained when $R = 1$. If $\delta < \tilde{\delta}(R_0, R_1) = 0.58$ also, the customs-union formation represented by the move from $R_0 = 2$ to $R_1 = 1$ will be bad for multilateral cooperation in the stationary dynamic game. Second, as we will show below, even adopting this “pessimistic” view of the stationary effect of customs unions on multilateral cooperation, there will nevertheless be a honeymoon phase during which multilateral tariffs first fall before they later rise.

2.3. Summary

We summarize the results of this section with the following proposition:

Proposition 1.

(i) *The Nash equilibrium of the static tariff game occurs when each region sets an external import tariff of $\hat{\tau}^N(R) = 2/(\beta(4R - 1))$.*

(ii) *The most-cooperative equilibrium of the stationary dynamic game occurs when each region sets an external tariff of*

$$\hat{\tau}_s^c(R) = \hat{\tau}^N(R) \left\{ \frac{(4R - 1)^2(1 - \delta) - 2\delta(4R^2 - 1)}{(4R - 1)^2(1 - \delta) + 2\delta(4R^2 - 1)} \right\}$$

provided that $\delta \in (0, \delta(R))$.

3. The formation of customs unions

We turn now to a dynamic model in which, at some point in time, customs-union expansion occurs, in that the number of domestic regions and also the number of foreign regions decreases. While understanding the timing of customs-union formation is important in its own right, it is a problem that has many dimensions, and a proper treatment is well beyond the scope of this paper. Instead, we assume that the process of customs-union expansion occurs randomly and for exogenous, political reasons. The possibility that the number of regions may change through time introduces a non-stationarity into the dynamic interaction between countries, and our focus here is on how customs-union expansion affects the ability of domestic and foreign regions to continue to cooperate multilaterally in the setting of low tariffs.

3.1. The customs-union model

We envision a multilateral trading relationship that passes through three phases. Countries seek to maintain low multilateral trade barriers in each phase. In phase 1, there are R_0 domestic regions and also R_0 foreign regions. The domestic and foreign regions trade with one another just as above. The countries are aware, however, that a time may come at which it becomes politically feasible for customs-union expansion to occur, both among domestic countries and among foreign countries. Phase 2 corresponds to a transition phase, in which there are still R_0 regions of each type, but in which customs-union-expansion discussions have already commenced. Finally, in phase 3, the customs-union-expansion talks are completed, the new regions are fully implemented, and there are now R_1 regions of each type, where $R_1 < R_0$. This final set of trading patterns then persists into the infinite future.

Equilibria of repeated games with non-stationarities are often difficult to characterize. For tractability, therefore, we impose two assumptions. First, we assume that the transition process obeys a constant-hazard-rate (i.e. stationary-

Markov) property. Namely, if the countries are in phase 1 at any date t , then $\rho \in (0,1)$ is the constant probability that they will be in phase 2 at date $t+1$. Similarly, $\lambda \in (0,1)$ is the fixed conditional probability of transition from phase 2 to phase 3. Note that ρ and λ are assumed independent of the tariff history between countries. As will become clear, while the constant-hazard-rate assumption is not completely general, it does make possible some very precise predictions. Second, we assume that the domestic and foreign countries pass through their respective phases at the same dates. This enables us to exploit symmetry between the two country types, and thereby simplifies the analysis.

The *customs-union game* is now defined as the infinite-period game, in which countries pass through the described three phases, and regions select tariffs in each period with the goal of maximizing the welfare of their respective current-member countries, where at any given date all regions are perfectly informed as to past tariffs and the current phase of the game. For this game, we examine a class of subgame perfect equilibria, for which (i) along the equilibrium path, in any given phase of the game, the domestic and foreign regions select a common import tariff for all dates within that phase; and (ii) if at any point in the game a deviation from the equilibrium tariff for the corresponding phase occurs, then in the next period and forever thereafter all regions select the Nash equilibrium tariffs of the relevant static tariff game.¹²

For such equilibria, there will be three cooperative tariff levels, with each corresponding to a different phase. Let τ_1^c , τ_2^c and τ_3^c refer to the cooperative tariff levels in phases 1, 2 and 3 respectively. Once again, we look for a most-cooperative equilibrium, and we solve for the associated most-cooperative tariffs, $\hat{\tau}_1^c$, $\hat{\tau}_2^c$ and $\hat{\tau}_3^c$. The most-cooperative tariffs may be found using a recursive solution approach. Specifically, we first identify the no-defect condition for phase 3 and find the lowest tariff that can be supported in this phase in an equilibrium of the desired class. With $\hat{\tau}_3^c$ thus determined, we next turn to phase 2, represent the relevant no-defect condition for this phase, and then solve for the phase-2 most-cooperative tariff, $\hat{\tau}_2^c$. Finally, having solved for the most-cooperative tariffs in phases 2 and 3, we characterize next the no-defect condition for phase 1 and solve for the lowest tariff in this phase that does not invite cheating. The resulting tariff is the most-cooperative phase-1 tariff, $\hat{\tau}_1^c$. This recursive method does indeed identify the most-cooperative tariffs for the overall game, since the discounted value of cooperation as viewed from any given phase rises as future cooperative tariffs drop. Thus, by selecting the lowest possible cooperative phase-3 tariff, we raise the cost to countries of defecting and igniting a trade war in phases 2 and 1, and we thereby make possible lower tariffs in these phases as well. Similarly, a lower phase-2 tariff makes it possible to support lower cooperative tariffs in phase 1.

¹²Note that the constant hazard rate assumption enables us to look for a single tariff for all dates within a phase. Observe also that the level of the static Nash tariff will depend upon the phase, since as shown above the Nash tariff is sensitive to the number of existing regions.

We are now ready to formally represent the no-defect conditions for each of the three phases. Let us begin with phase 3. At any date within this phase, there are R_1 regions of each kind, the future is known to be stationary, and the no-defect condition is:

$$\Omega(R_1, \tau_3^c) \leq \frac{\delta}{1 - \delta} \omega(R_1, \tau_3^c). \quad (17)$$

This has the same form as Eq. (9), the no-defect condition in our stationary model, except that the number of regions is now R_1 . Thus, it follows that $\hat{\tau}_3^c = \hat{\tau}_s^c(R_1)$; in other words, the phase-3 most-cooperative tariff is the most-cooperative stationary tariff for a world in which there are R_1 domestic and foreign customs unions, respectively.

Consider now phase 2. The no-defect condition for this phase is:

$$\Omega(R_0, \tau_2^c) \leq \delta \sum_{n=1}^{\infty} \lambda (1 - \lambda)^{n-1} \left[\sum_{q=1}^{n-1} \delta^{q-1} \omega(R_0, \tau_2^c) + \sum_{k=n}^{\infty} \delta^{k-1} \omega(R_1, \hat{\tau}_3^c) \right] \quad (18a)$$

where n indexes the period at which phase 3 begins, with $n = 1$ meaning that phase 3 begins in the next period, and where q and k correspond to periods within phases 2 and 3, respectively.¹³ Observe in phase 2 that there are R_0 domestic and foreign regions, respectively, and this is reflected in the left-hand side of Eq. (18a). With some further simplification, the phase-2 no-defect condition may be written as:

$$\begin{aligned} \Omega(R_0, \tau_2^c) &\leq \frac{(1 - \lambda)\delta}{[1 - (1 - \lambda)\delta]} \omega(R_0, \tau_2^c) + \frac{\lambda\delta/(1 - \delta)}{[1 - (1 - \lambda)\delta]} \omega(R_1, \hat{\tau}_3^c) \\ &\equiv V_2(\tau_2^c; \lambda, \delta, R_0, R_1) \end{aligned} \quad (18b)$$

where V_2 is defined to be the expected discounted value to future cooperation, as viewed in phase 2. Intuitively, V_2 is a weighted average of $\omega(R_0, \tau_2^c)$ and $\omega(R_1, \hat{\tau}_3^c)$, since a defection in phase 2 induces a trade war, thus sacrificing the cooperative welfare that could have been received in the remainder of phase 2 (at the tariff level τ_2^c) as well as the cooperative welfare that would have been forthcoming once phase 3 was entered (at the tariff level $\hat{\tau}_3^c$). The lowest tariff satisfying Eq. (18b) defines $\hat{\tau}_2^c$.

Finally, we come to the phase-1 no-defect condition:

$$\begin{aligned} \Omega(R_0, \tau_1^c) &\leq \delta \sum_{s=1}^{\infty} \rho (1 - \rho)^{s-1} \left[\sum_{t=1}^{s-1} \delta^{t-1} \omega(R_0, \tau_1^c) \right. \\ &\quad \left. + \delta^{s-1} (\omega(R_0, \hat{\tau}_2^c) + V_2(\hat{\tau}_2^c; \lambda, \delta, R_0, R_1)) \right] \end{aligned} \quad (19a)$$

¹³ $\sum_{q=1}^0 \delta^{q-1} \omega \equiv 0$ is understood here.

where s indexes the period at which phase 2 begins, with $s = 1$ meaning that phase 2 begins in the next period, and where t represents periods within phase 1. Using Eq. (18b), Eq. (19a) becomes:

$$\begin{aligned}\Omega(R_0, \tau_1^c) &\leq \frac{(1-\rho)\delta}{[1-(1-\rho)\delta]} \omega(R_0, \tau_1^c) \\ &\quad + \frac{\rho\delta}{[1-(1-\rho)\delta]} \frac{\{\omega(R_0, \hat{\tau}_2^c) + [\lambda\delta/(1-\delta)]\omega(R_1, \hat{\tau}_3^c)\}}{[1-(1-\lambda)\delta]} \\ &\equiv V_1(\tau_1^c; \rho, \lambda, \delta, R_0, R_1)\end{aligned}\quad (19b)$$

where V_1 gives the expected discounted value to future cooperation as viewed from phase 1. Note now that V_1 is a weighted average of $\omega(R_0, \tau_1^c)$, $\omega(R_0, \hat{\tau}_2^c)$ and $\omega(R_1, \hat{\tau}_3^c)$, reflecting the fact that a deviation in phase 1 sacrifices the ability to cooperate in the remainder of phase 1 as well as throughout phases 2 and 3. The smallest tariff satisfying Eq. (19b) is then defined to be $\hat{\tau}_1^c$.

3.2. Characterization of the most-cooperative tariffs

We are prepared now to characterize the three most-cooperative tariff levels, so that their relative magnitudes may be determined. In this way, we will be able to assess the consequences of customs-union expansion for multilateral tariff cooperation.

The tariffs are characterized in a recursive fashion, beginning with the phase-3 most-cooperative tariff. As discussed above, this tariff is simply the most-cooperative stationary tariff for a world in which there are R_1 customs unions of each country type:

Lemma 1.

$$0 < \hat{\tau}_3^c = \hat{\tau}_s^c(R_1) < \hat{\tau}^N(R_1).$$

Thus, over the range of discount factors on which we focus, the phase-3 most-cooperative tariff lies between free trade and the Nash tariff (for R_1 regions).

Consider now the phase-2 most-cooperative tariff. To characterize this tariff, we first record the following:

Lemma 2.

$$\omega(R_1, \hat{\tau}_s^c(R_1)) > \omega(R_0, \hat{\tau}_s^c(R_0)).$$

Lemma 2 states that the per-period value of cooperation at the most-cooperative *stationary* tariff is highest when there are fewer regions. Intuitively, two forces are at work in the proof of this lemma. First, for any fixed cooperative tariff, a smaller number of regions results in a greater value of cooperation, as Eq. (14)

demonstrates, since under the market power effect a trade war is more damaging when regions are larger in size and fewer in number. Second, over the range for δ on which we focus, the most-cooperative stationary tariff is higher when there are fewer regions, and, as Eq. (15) indicates, this higher cooperative tariff acts to diminish the gain from cooperation. Lemma 2 establishes that the direct effect of a smaller number of regions outweighs the indirect effect of a higher cooperative tariff, and so the per-period value of cooperation at the most-cooperative stationary tariff is higher when there are fewer regions. A proof of this lemma is found in Appendix A.

With Lemma 2 in place, we can record some properties of the V_2 function:

$$\frac{\partial V_2(\tau_2^c; \lambda, \delta, R_0, R_1)}{\partial \tau_2^c} < 0 \quad (20)$$

$$V_2(\hat{\tau}_s^c(R_0); \lambda, \delta, R_0, R_1) > \frac{\delta}{1 - \delta} \omega(R_0, \hat{\tau}_s^c(R_0)). \quad (21)$$

Intuitively, the discounted value of future cooperation as viewed from phase 2 is lower when the cooperative tariff in phase 2 is higher, since in this case cooperation in phase 2 is already modest, and so a trade war instigated in this phase would result in less welfare loss during any remaining periods of phase 2. More formally, Eq. (20) follows directly from Eq. (18b) and Eq. (15). As for Eq. (21), observe from Lemma 1 and Eq. (18b) that $V_2(\hat{\tau}_s^c(R_0); \cdot)$ is a weighted average of $\omega(R_0, \hat{\tau}_s^c(R_0))$ and $\omega(R_1, \hat{\tau}_s^c(R_1))$, the per-period values of cooperation at the most-cooperative stationary tariffs when there are R_0 and R_1 regions, respectively. Now, Lemma 2 tells us that the per-period value of cooperation at the most-cooperative stationary tariff is greatest when the number of regions is small, and it thus must be that the discounted value of future cooperation as viewed from phase 2 exceeds that obtained in a stationary setting with a large number of regions.¹⁴ Fig. 3 illustrates the implications of Eq. (20) and Eq. (21) by depicting $V_2(\tau_2^c = \tau^c; \cdot)$ as declining in τ^c and lying strictly above $(\delta/(1 - \delta))\omega(R_0, \tau^c)$ at $\tau^c = \hat{\tau}_s^c(R_0)$.

It is convenient to ensure that free trade is never supportable, and that the no-defect condition therefore always binds with equality. To guarantee this, we further require that:

$$\Omega(R_0, 0) > \frac{\delta}{1 - \delta} \omega(R_1, 0) \quad (22)$$

which in turn implies that $\Omega(R_0, 0) > V_2(0; \cdot)$, indicating that free trade is not

¹⁴Formally, Lemmas 1 and 2 imply

$$\begin{aligned} V_2(\hat{\tau}_s^c(R_0); \cdot) &= \{(1 - \lambda)\delta/[1 - (1 - \lambda)\delta]\}\omega(R_0, \hat{\tau}_s^c(R_0)) + \{\lambda\delta/(1 - \delta)\}/[1 - (1 - \lambda)\delta]\}\omega(R_1, \hat{\tau}_s^c) \\ &> \{(1 - \lambda)\delta/[1 - (1 - \lambda)\delta]\}\omega(R_0, \hat{\tau}_s^c(R_0)) + \{\lambda\delta/(1 - \delta)\}/[1 - (1 - \lambda)\delta]\}\omega(R_0, \hat{\tau}_s^c(R_0)) \\ &= [\delta/(1 - \delta)]\omega(R_0, \hat{\tau}_s^c(R_0)). \end{aligned}$$

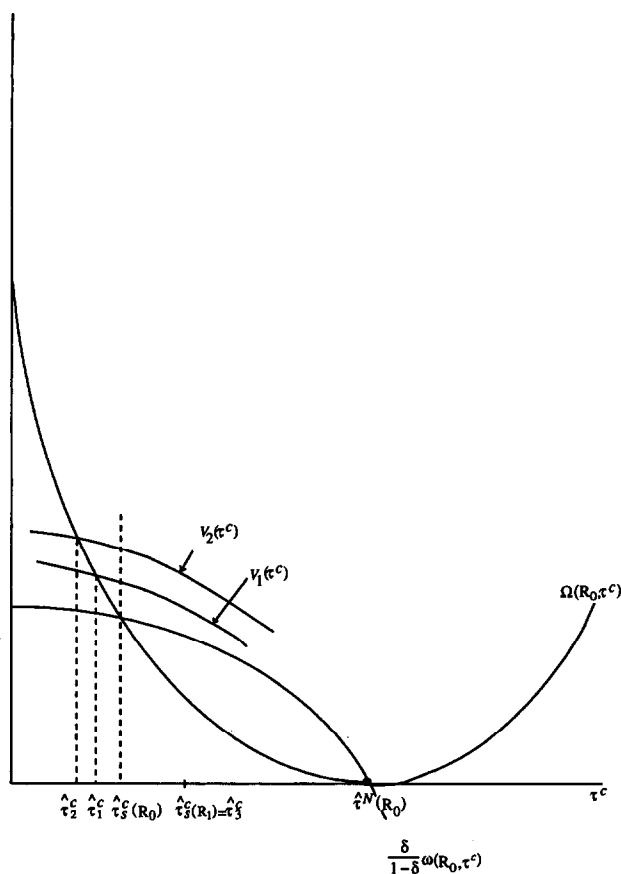


Fig. 3. Determining the most-cooperative tariffs in the customs-union game.

supportable in phase 2.¹⁵ Observe that Eq. (22) will clearly hold under our existing assumptions if $R_0 - R_1$ is small, since in that event Eq. (22) basically requires again that free trade not be supportable in stationary environments. More generally, Eq. (22) is satisfied if δ is restricted to lie below some critical level, $\delta^\dagger(R_0, R_1)$.¹⁶ Thus, Eq. (22) may be understood as a further strengthening of our small- δ orientation.

¹⁵To see this, observe that

$$\begin{aligned} V_2(0; \cdot) &\equiv \{[(1 - \lambda)\delta]/[1 - (1 - \lambda)\delta]\}\omega(R_0, 0) + \{[\lambda\delta/(1 - \delta)]/[1 - (1 - \lambda)\delta]\}\omega(R_1, \hat{\tau}_3^c) \\ &< \{[(1 - \lambda)\delta]/[1 - (1 - \lambda)\delta]\}\omega(R_0, 0) + \{[\lambda\delta/(1 - \delta)]/[1 - (1 - \lambda)\delta]\}\omega(R_1, 0) \\ &< [\delta/(1 - \delta)]\omega(R_1, 0), \end{aligned}$$

which uses Eq. (14) and Eq. (15).

¹⁶Specifically, Eq. (22) holds if $\delta < \delta^\dagger(R_0, R_1) \equiv [R_1(4R_1 - 1)^2]/[R_1(4R_1 - 1)^2 + 2R_0(4R_0^2 - 1)]$.

We are now prepared to characterize $\hat{\tau}_2^c$, which is the lowest tariff for which $\Omega(R_0, \tau_2^c) \leq V_2(\tau_2^c; \lambda, \delta, R_0, R_1)$. As Fig. 3 illustrates, given Eq. (20), Eq. (21) and Eq. (22), $\hat{\tau}_2^c$ must lie strictly between 0 and $\hat{\tau}_3^c$:

Lemma 3.

$$0 < \hat{\tau}_2^c < \hat{\tau}_3^c.$$

Thus, a honeymoon phase occurs during the transition to a fully implemented customs union, as multilateral tariffs are low throughout this process. Once the customs-union expansion is fully implemented, however, multilateral tariff cooperation must deteriorate and higher multilateral tariffs prevail.

Lemma 3 may be understood in the following intuitive terms. If the number of regions were stationary through time, with R_0 regions of each type of country, then the regions could support a tariff level of $\hat{\tau}_s^c(R_0)$, as this is the tariff that just balances a region's immediate incentive to cheat against the long-term consequences of a trade war. This situation now may be contrasted with that which arises in the transition phase of the customs-union game. At this point, the various countries are still aligned with R_0 regions of each country type, and so the incentive to cheat is the same as in the associated dynamic stationary game, but the countries are also aware that customs-union expansion – and the greater punishment that this makes possible – will soon occur. Thus, as compared with the stationary environment that supports $\hat{\tau}_s^c(R_0)$, in the transition phase of the customs-union game, the countries perceive the expected discounted value of future cooperation now to be higher (as Eq. (21) states). It follows, therefore, that the most-cooperative stationary tariff, $\hat{\tau}_s^c(R_0)$, is easily supported in the transition phase of the customs-union game. In fact, the balance between the incentive to cheat and the expected discounted value of future cooperation is not restored until a lower phase-2 cooperative tariff is selected and the incentive to cheat is correspondingly raised to a level commensurate with the expected discounted value of future cooperation. Hence, it must be that $\hat{\tau}_2^c < \hat{\tau}_s^c(R_0)$. The final step now is to recall that $\hat{\tau}_s^c(R_0) < \hat{\tau}_s^c(R_1) = \hat{\tau}_3^c$, and so the phase-3 most-cooperative tariff must exceed the phase-2 most-cooperative tariff.

More generally, the honeymoon prediction may be understood as a reflection of the evolution of market power throughout the customs-union game. While customs unions are being negotiated and phased in, countries recognize that once these larger regions are in place, the world will have better enforcers, because under the market power effect larger regions can credibly impose higher Nash tariffs, should such punitive tariffs be called for. The prospect that a trade war initiated today might reach such proportions in the future then makes countries reluctant to pursue unilateral objectives in the present, and so the recognition of eventual customs-union expansion gives rise to a honeymoon period in which low multilateral tariffs can be supported. This honeymoon eventually gives way, however, since once the customs-unions are actually expanded, each country realizes that its region's

enhanced market power also makes possible a large welfare gain from defection to a higher import tariff. Thus, after the customs-union expansion is finalized, multilateral tariffs must rise to diminish the incentive to cheat and restore balance.

We turn next to the initial-phase tariff, $\hat{\tau}_1^c$, which is the lowest tariff such that $\Omega(R_0, \tau_1^c) \leq V_1(\tau_1^c; \rho, \lambda, \delta, R_0, R_1)$. To characterize this tariff, we first show that:

Lemma 4.

$$\omega(R_1, \hat{\tau}_s^c(R_1)) > \omega(R_0, \hat{\tau}_2^c).$$

Recalling that $\hat{\tau}_s^c(R_1) = \hat{\tau}_3^c$, we see that Lemma 4 states that the per-period equilibrium value of cooperation rises from phase 2 to phase 3. Once again, there are two effects, as phase 3 involves a smaller number of regions, which act to raise the per-period value of cooperation, and yet phase 3 also entails a higher most-cooperative tariff (by Lemma 3), which works to reduce the per-period value of cooperation in phase 3. As above, however, the direct effect of a smaller number of regions dominates, and thus the per-period equilibrium value of cooperation is higher in phase 3. This lemma is proved in Appendix A.

Three key properties of the V_1 function may now be reported:

$$\frac{\partial V_1(\tau_1^c; \rho, \lambda, \delta, R_0, R_1)}{\partial \tau_1^c} < 0 \quad (23)$$

$$V_1(\hat{\tau}_2^c; \rho, \lambda, \delta, R_0, R_1) < V_2(\hat{\tau}_2^c; \lambda, \delta, R_0, R_1) \quad (24)$$

$$V_1(\hat{\tau}_s^c(R_0); \rho, \lambda, \delta, R_0, R_1) > \frac{\delta}{1 - \delta} \omega(R_0, \hat{\tau}_s^c(R_0)). \quad (25)$$

As before, a higher cooperative tariff reduces the fear of a trade war, at least during the associated phase, and therefore reduces the overall expected discounted value of future cooperation. More formally, Eq. (23) is direct from Eq. (19b) and Eq. (15). To understand Eq. (24), observe that, under Lemma 4, the per-period equilibrium value of cooperation is higher in phase 3 than in phase 2; consequently, the expected discounted value of future cooperation is higher in phase 2 than in phase 1 (at the relevant tariff), because the transition to phase 3 is more imminent when countries begin in phase 2.¹⁷ Finally, to gain some insight into Eq. (25), recall that $V_1(\hat{\tau}_s^c(R_0); \cdot)$ is a weighted average of the associated per-period values of cooperation across the three phases, namely, $\omega(R_0, \hat{\tau}_s^c(R_0))$, $\omega(R_0, \hat{\tau}_2^c)$ and $\omega(R_1, \hat{\tau}_s^c(R_1))$; however, the per-period value of cooperation in the third phase exceeds that in the first by Lemma 2, and the per-period value of cooperation in the second phase also exceeds that in the first, since the most-cooperative

¹⁷Formally, using Lemma 4, calculations reveal that:

$$V_2(\hat{\tau}_2^c; \lambda, \delta, R_0, R_1) - V_1(\hat{\tau}_2^c; \rho, \lambda, \delta, R_0, R_1) = \{\lambda \delta / [1 - (1 - \lambda)\delta][1 - (1 - \rho)\delta]\} [\omega(R_1, \hat{\tau}_s^c(R_1)) - \omega(R_0, \hat{\tau}_2^c)] > 0.$$

second-phase tariff is lower than the most-cooperative stationary tariff that is specified in Eq. (25) for the first phase. Thus, Eq. (25) clearly must hold.¹⁸

The implications of Eq. (23), Eq. (24) and Eq. (25) are illustrated in Fig. 3, which depicts $V_1(\tau_1^c = \tau^c; \cdot)$ as declining in τ^c , lying strictly below $V_2(\tau_2^c = \tau^c; \cdot)$ at $\tau^c = \hat{\tau}_2^c$, and lying strictly above $(\delta/(1-\delta))\omega(R_0, \tau^c)$ at $\tau^c = \hat{\tau}_s^c(R_0)$. We may thus conclude, as Fig. 3 illustrates, that:

Lemma 5.

$$\hat{\tau}_2^c < \hat{\tau}_1^c < \hat{\tau}_3^c.$$

Thus the initial-phase tariff is lower than the final-phase tariff, but it is not as low as the tariff that occurs during the transition phase.

The intuition underlying Lemma 5 is easily related. Consider first why tariffs are lower in the initial phase than in the final phase. When the countries are in phase 1, there are R_0 regions, and each of these small regions has some incentive to cheat. Balancing against this defection incentive is the cost of a future trade war, and if the world were stationary with R_0 regions of each country type for ever, then the incentive to cheat would be just balanced against the cost of a trade war at the most-cooperative stationary tariff, $\hat{\tau}_s^c(R_0)$. In phase 1 of the customs-union game, however, the countries recognize that (i) the very cooperative honeymoon phase will arrive soon, and (ii) eventually customs-union expansion will occur and there will be only R_1 regions of each country type. For both of these reasons, the expected discounted value of future cooperation (i.e. the expected cost of a trade war) is quite high as viewed from phase 1 (as Eq. (25) indicates), and so the most-cooperative stationary tariff with R_0 regions is easily supported in phase 1 of the customs-union game. In fact, an even lower cooperative tariff (with the concomitant larger defection incentive) can be supported at this phase, and it therefore follows that $\hat{\tau}_1^c < \hat{\tau}_s^c(R_0) < \hat{\tau}_s^c(R_1) = \hat{\tau}_3^c$.

At a more general level, before countries begin negotiations on customs-union expansion, each region has little market power, since each region is comprised of only a few countries. Given this, there is little benefit to the countries in a region from cheating and selecting a high tariff. On the other hand, the countries correctly perceive that larger regions with great market power are on the horizon; thus, a trade war begun today would sacrifice the very cooperative tariffs that would otherwise be enjoyed while the customs-union expansion was being negotiated and phased in, and it would also culminate in a very costly tariff war once the large regions were actually in place. This imbalance between a low current gain from

¹⁸Formally, Lemmas 1 and 2 and also $\hat{\tau}_2^c < \hat{\tau}_s^c(R_0)$ and Eq. (15) imply that

$$\begin{aligned} V_1(\hat{\tau}_s^c(R_0); \cdot) &= \{(1-\rho)\delta/[1-(1-\rho)\delta]\}\omega(R_0, \hat{\tau}_s^c(R_0)) + \{\rho\delta/[1-(1-\rho)\delta]\}\{\omega(R_0, \hat{\tau}_2^c) + [\lambda\delta/(1-\delta)]\omega(R_1, \hat{\tau}_3^c)\}/[1-(1-\lambda)\delta] \\ &> \{(1-\rho)\delta/[1-(1-\rho)\delta]\}\omega(R_0, \hat{\tau}_s^c(R_0)) + \{\rho\delta/[1-(1-\rho)\delta]\}\{\omega(R_0, \hat{\tau}_s^c(R_0)) + [\lambda\delta/(1-\delta)]\omega(R_0, \hat{\tau}_s^c(R_0))\}/[1-(1-\lambda)\delta] \\ &= \{\delta/(1-\delta)\}\omega(R_0, \hat{\tau}_s^c(R_0)). \end{aligned}$$

cheating and a large future cost to a trade war enables the countries to support a very low cooperative tariff in the period of time that precedes customs-union negotiations. Once the customs unions are fully implemented, however, the natural balance between the incentive to cheat and the expected discounted value of future cooperation is restored, since each region then has substantial market power in the present, with the corresponding greater incentive to cheat. Thus, once customs unions are fully implemented (in phase 3), the cooperative tariff must rise above that found prior to customs-union negotiations (in phase 1).

Finally, consider why the phase-2 most-cooperative tariff is lower than the phase-1 most-cooperative tariff. In both phases, the incentive to cheat is small, since a region has little market power, being comprised of only R_0 countries. The essential difference between the initial and transition phases is that actual customs-union expansion can be expected to occur sooner when countries are already in the negotiation or transition phase. As Eq. (24) indicates, this in turn means the expected discounted value to future cooperation is higher in phase 2, since a trade war initiated in that phase will be exacerbated more quickly by the higher Nash tariffs that large regions are prone to select. Hence, a lower cooperative tariff can be supported in phase 2.

Our main results may now be summarized in the following proposition:

Proposition 2. For the customs-union game, in the most-cooperative equilibrium, the domestic and foreign regions set the most-cooperative import tariffs, $\hat{\tau}_1^c$, $\hat{\tau}_2^c$ and $\hat{\tau}_3^c$ in phases 1, 2 and 3, respectively, and these tariffs may be ranked as follows: $0 < \hat{\tau}_2^c < \hat{\tau}_1^c < \hat{\tau}_3^c$.

These rankings are captured in Fig. 4, which depicts the most-cooperative tariffs in the three phases of the customs-union game. As the figure illustrates, the prospect of a future customs-union expansion serves to lower current cooperative tariffs, and particularly so as the expansion becomes more imminent. Once the customs-union expansion is fully implemented, however, multilateral tariffs must rise to maintain cooperation.

4. Comparative statics

The customs-union model developed above has a variety of parameters, and it is important to assess the sensitivity of the most-cooperative tariffs to these parameters. In addition, some of these parameters may be loosely associated with aspects of GATT policy toward customs unions as embodied in Article XXIV. Thus, in this section, we present comparative-statics results, and in the concluding section we discuss their implications with regard to the design of Article XXIV. Examining the respective no-defect conditions presented above, it is apparent that

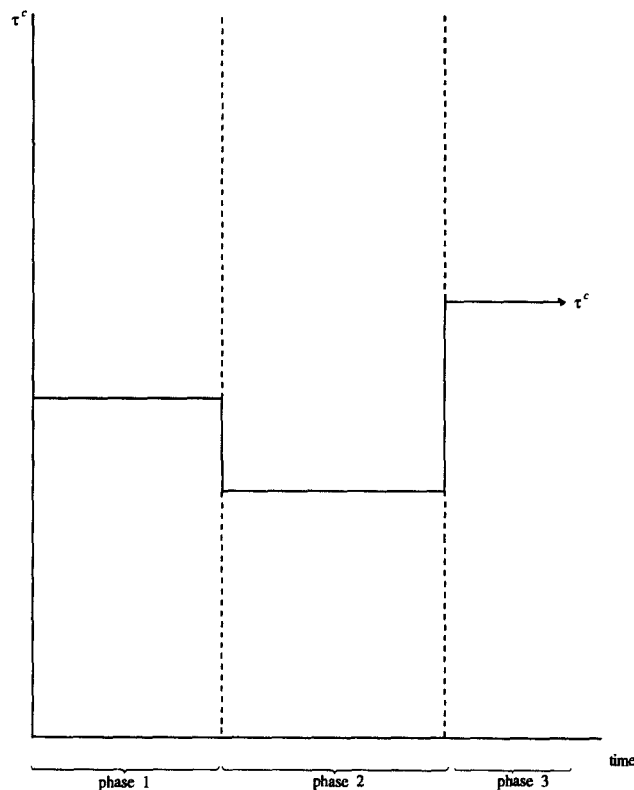


Fig. 4. The 'honeymoon' effect of customs-union formation.

the most-cooperative tariffs have the following functional dependencies: $\hat{\tau}_3^c = \hat{\tau}_3^c(\delta, R_1)$, $\hat{\tau}_2^c = \hat{\tau}_2^c(\lambda, \delta, R_0, R_1)$ and $\hat{\tau}_1^c = \hat{\tau}_1^c(\rho, \lambda, \delta, R_0, R_1)$.

Before proceeding, it is important to record the following corollary:

Corollary 1.

$$\omega(R_1, \hat{\tau}_3^c) > \omega(R_0, \hat{\tau}_2^c) > \omega(R_0, \hat{\tau}_1^c).$$

Corollary 1 indicates that the per-period equilibrium value of cooperation increases through time. The proof is direct, as the first inequality is simply a restatement of Lemma 4 (recall that $\hat{\tau}_3^c = \hat{\tau}_s^c(R_1)$), while the second inequality follows from Proposition 2 and Eq. (15). This corollary will be important for the proofs of the comparative-statics results derived below.

Our central set of results is contained in the following proposition:

Proposition 3. For the customs-union game, the most-cooperative tariffs satisfy the following relationships:

- (i) $\hat{\tau}_1^c(\rho, \lambda, \delta, R_0, R_1)$ is decreasing in ρ , λ and δ , and it is increasing in R_1 .
- (ii) $\hat{\tau}_2^c(\lambda, \delta, R_0, R_1)$ is decreasing in λ and δ , and it is increasing in R_1 .
- (iii) $\hat{\tau}_3^c(\delta, R_1)$ is decreasing in δ , and decreasing in R_1 if δ is sufficiently small.

The proof of this proposition is in Appendix A.

To gain some intuition, let us start with the effect of an increase in ρ on the phase-1 most-cooperative tariff. As ρ rises, countries that are currently in phase 1 recognize that the transition to phase 2 and, ultimately, the transition to phase 3 will occur sooner. This in turn raises the expected discounted value to cooperation (i.e. V_1) as viewed from phase 1, since Corollary 1 establishes that the per-period equilibrium value of cooperation is larger in later phases. With the perceived cost of a trade war thereby increased, lower phase-1 tariffs (with the associated higher incentive to cheat) can be supported. Hence, an increase in the likelihood that customs unions will be formed in the near future will give a temporary boost to multilateral cooperation.

The consequences of a larger value for λ are similar, although the argument is slightly more involved. Consider first the phase-2 most-cooperative tariff. As λ rises, the transition to the final phase is expedited, and, using Corollary 1 once more, it follows that the expected discounted value of future cooperation (i.e. V_2) as viewed from phase 2 rises. Thus, a higher value for λ acts to lower the phase-2 most-cooperative tariff. In phase 1, a higher λ also results in a lower most-cooperative tariff, though now for two reasons. First, as before, when λ is increased, the final phase is reached more quickly, and using Corollary 1 this enables a lower phase-1 most-cooperative tariff. Second, an increase in λ lowers the phase-2 most-cooperative tariff, as argued just above, and the anticipation of this more-cooperative phase-2 behavior in turn acts to raise the expected discounted value of future cooperation as viewed from phase 1, thereby making possible a lower phase-1 most-cooperative tariff. Thus, for both direct and indirect reasons, a higher value for λ results in a lower phase-1 most-cooperative tariff.

An increase in δ has the anticipated effect on the most-cooperative tariffs, as all such tariffs then decline. Intuitively, the direct effect of an increase in δ is that the future is valued more, and so countries are more reluctant to sacrifice cooperation and enter into a trade war. Thus, a higher value for δ serves to raise the expected discounted value to future cooperation, and thereby makes possible the support of lower most-cooperative tariffs in all phases. Second, for phases 1 and 2, an increase in δ also has beneficial indirect effects. For example, in phase 2, when δ increases, countries recognize that the phase-3 most-cooperative tariff will be lower as a result, and so the cost of a future trade war is raised for this reason as well. Similar indirect effects arise in phase 1.

Finally, we may view R_0 as an initial condition and investigate the consequences of greater customs-union expansion by allowing R_1 to be smaller. For

sufficiently small δ , a decrease in R_1 raises the phase-3 most-cooperative tariff. Intuitively, as Lemma 1 indicates, the phase-3 most-cooperative tariff is simply the most-cooperative stationary tariff for a world with R_1 regions of each country type. Further, as we argued in Section 2, in stationary environments a reduction in the number of regions enhances each region's market power, and this results in a higher most-cooperative stationary tariff if countries discount the future sufficiently. Thus, given our small- δ orientation, it must be that the phase-3 most-cooperative tariff rises as customs-union expansion becomes more significant.¹⁹

The effect of greater customs-union expansion generates a rather different consequence for the phase-1 and phase-2 most-cooperative tariffs. As we show in Appendix A while proving Lemma 2, a key feature of our model is that $\omega(R, \hat{\tau}_s^c(R)) \equiv f(R)$ is declining in R , so that the per-period value of cooperation at the most-cooperative stationary tariff is always higher when there are fewer regions. In other words, the direct positive effect that a reduction in the number of regions has for the per-period value of cooperation always outweighs any possible negative indirect effect from a consequent increase in the most-cooperative stationary tariff.²⁰ Using Lemma 1, it follows immediately that a reduction in R_1 acts to raise the per-period equilibrium value of cooperation in phase 3, and this in turn implies that a lower phase-2 most-cooperative tariff can be supported when greater customs-union expansion is anticipated. Given that greater customs-union expansion has the direct effect of raising the per-period equilibrium value of cooperation in phase 3 and the indirect effect of lowering the phase-2 most cooperative tariff, it follows that the expected discounted value of future cooperation (i.e. V_1) as viewed from phase 1 rises for two reasons, and a lower phase-1 most-cooperative tariff can be supported as a result.

Thus, in general, customs-union expansion has a beneficial effect on multilateral tariff cooperation before the expansion is fully implemented. Further, any parameter change that speeds up the transitional process that leads to customs-union expansion, or which increases the extent of the eventual expansion, will

¹⁹Heretofore, we have assumed that δ is sufficiently small that a customs-union expansion in which the number of regions of each country type changed from R_0 to R_1 would result in a higher most-cooperative stationary tariff. This defines a range of δ , which we stated as $\delta \leq \bar{\delta}(R_0, R_1)$, and we argued in Section 2 that this range seemed to rule out few δ , other than those which we had already ruled out in assuming that free trade is not viable. The comparative static investigated here is slightly different, since R_0 is held fixed and we examine what happens to the most-cooperative stationary tariff as R_1 declines. Thus, if $\delta \leq \bar{\delta}(R_1, R_1 - \varepsilon)$, then the most-cooperative stationary tariff will rise as R_1 declines. This additional small- δ restriction appears to rule out few if any additional values for δ ; for example, when $R_1 = 2$, $\bar{\delta}(2, 2 - \varepsilon) = 0.59$. Recall that $\bar{\delta}(2, 1) = 0.58$. Nevertheless, because $\delta \leq \bar{\delta}(R_1, R_1 - \varepsilon)$ is not a maintained assumption on δ , as it is employed only in deriving the comparative static for the phase-3 most-cooperative tariff as a function of R_1 , we have included in the statement of Proposition 3 that this comparative static need hold only for sufficiently small δ .

²⁰This result does not require any additional assumption on the range of permissible δ (for example, $\delta \leq \bar{\delta}(R_1, R_1 - \varepsilon)$), and so parts (i) and (ii) of Proposition 3 are stated without additional restrictions on δ .

result in even greater multilateral tariff cooperation prior to the full implementation of the regional agreements. On the down side, however, if countries are sufficiently impatient, greater regional expansion can have negative consequences for multilateral tariff cooperation once the expansion is fully implemented. In this sense, our results imply that the formation of customs unions will enhance multilateral cooperation in the early stages of the regional integration process, but that multilateral cooperation is likely to suffer once this formation process is complete.

5. Conclusion

We have presented a model of customs unions which predicts that the early stages of the process of customs-union formation will lead to a temporary honeymoon for liberal multilateral trade policies which ultimately must be reversed as the customs union becomes fully implemented. Intuitively, during the period of transition toward customs-union formation, non-member countries recognize that member countries will soon experience an enhancement of market power and find higher tariffs more attractive; thus, a trade war initiated in this period could have especially dire implications in the near future, and so low multilateral tariffs become feasible during the transition period. Once the customs union is complete, however, the market power consequences become real, and the customs union faces a greater incentive to defect to a higher tariff. A self-enforcing agreement can then be maintained only if multilateral tariffs rise, quelling the incentive to deviate.

We have highlighted the special effects of customs-union formation as distinct from the formation of free trade areas by constructing a model that isolates the market power effect which comes with customs-union formation, and abstracts from the trade diversion effect which is common to both customs unions and free trade agreements. Since a comparison of our results here with those of Bagwell and Staiger (1997), which considers free trade agreements and the associated trade diversion effect, establishes that trade diversion effects of regional agreements run opposite to market power effects in terms of their implications for multilateral tariff cooperation, we can only claim to have captured the implications of customs-union formation for multilateral tariff cooperation when the market power effect dominates the trade diversion effect.²¹ Nevertheless, the two papers together underscore the two distinct forces that determine the impacts of regional integration on multilateral tariff cooperation, with free trade agreements reflecting primarily the trade diversion effects and customs unions in general reflecting some combination of both trade diversion and market power effects.

²¹As discussed in footnote 7, sufficient trade diversion could also overturn our results through the possible effect on the relationship between static Nash tariffs and customs-union formation.

While a thorough understanding of the implications of the formation of the EC for multilateral tariff cooperation under GATT would require consideration of a variety of economic and political influences, our model does supply a novel perspective that is broadly consistent with facts. Provided that the market power effects of EC formation were sufficiently important relative to trade diversion effects, our model predicts that multilateral tariff liberalization would be initially stimulated by the formation and subsequent extension of the EC customs union, but that this complementarity would ultimately give way to a more dissonant relationship and multilateral tariff cooperation would suffer as a result.²²

Finally, we comment briefly on the institutional implications of our analysis with regard to the design of GATT Article XXIV. This article permits customs-union formation, provided that member countries achieve free trade on substantially all goods they trade and that the union is formed in a timely manner.²³ In terms of our model, these restrictions may be understood as an attempt to reduce the frequency with which such unions occur (related to the parameter ρ) and the length of the transition period to the fully implemented agreement (related to the parameter λ) from what these parameters would look like in an unrestricted world. The comparative statics results reported here suggest that Article XXIV could have important consequences for multilateral tariff cooperation. In particular, efforts to reduce the frequency with which customs-union agreements are negotiated will tend to diminish multilateral cooperation as long as those efforts are successful and customs-union formation is deterred, and will delay the start of the harmonious transition phase associated with the early stages of customs-union implementation, but will also postpone the post-customs-union high-tariff world. At the same time, efforts to shorten the transition period over which a customs-union agreement is implemented will tend to boost multilateral cooperation up until the final implementation is achieved, but such efforts will also hasten the arrival of the post-customs-union high-tariff world.

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²²Our model differs from the EC experience, in that we consider symmetric formation of customs unions. As we show in our earlier discussion paper (Bagwell and Staiger, 1993), however, our central results extend to the case of asymmetric customs-union formation.

²³As Dam (1970, chapter 16) argues, these restrictions are not always enforced.

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Appendix A

Proof of Lemma 2

Observe that

$$\frac{d\omega(R, \hat{\tau}_s^c(R))}{dR} = \frac{\partial\omega(R, \hat{\tau}_s^c(R))}{\partial R} + \frac{\partial\omega(R, \hat{\tau}_s^c(R))}{\partial\tau^c} \frac{\partial\hat{\tau}_s^c(R)}{\partial R}. \quad (\text{A.1})$$

To sign this expression, we first calculate that

$$\omega(R, \hat{\tau}_s^c(R)) = \frac{8\delta(1-\delta)(4R^2-1)}{K\beta[(4R-1)^2(1-\delta) + 2\delta(4R^2-1)]^2}. \quad (\text{A.2})$$

Further calculations then yield that

$$\begin{aligned} \frac{d\omega(R, \hat{\tau}_s^c(R))}{dR} &= \frac{64\delta(1-\delta)\{(8R^3-7R+2)\delta - (16R^3-9R+2)\}}{K\beta[(4R-1)^2(1-\delta) + 2\delta(4R^2-1)]^3} \\ &< 0 \end{aligned} \quad (\text{A.3})$$

where the inequality follows since the bracketed expression in the numerator is negative for all $\delta \in (0,1)$ and $R \geq 1$. \square

Proof of Lemma 4

Define $D(\tau_2^c) \equiv \omega(R_1, \hat{\tau}_s^c(R_1)) - \omega(R_0, \tau_2^c)$. Observe that $D(\tau_2^c)$ is increasing for $\tau_2^c > 0$; thus, since $\hat{\tau}_2^c > 0$, Lemma 4 is sure to hold if $D(0) \geq 0$. Assume then that $D(0) < 0$. In this event, using Lemma 2, there exists a unique $\tau^* \in (0, \hat{\tau}_s^c(R_0))$ at which $D(\tau^*) = 0$. The lemma is thus proved if $\hat{\tau}_2^c > \tau^*$.

Let $\hat{\tau}_2^c(\lambda = 1)$ denote the most-cooperative phase-2 tariff when $\lambda = 1$. Since under Eq. (22) the no-defect condition (Eq. (18b)) must hold with equality, we use $D(\tau^*) \equiv \omega(R_1, \hat{\tau}_s^c(R_1)) - \omega(R_0, \tau^*) = 0$ and Lemma 1 to conclude that

$$\Omega(R_0, \hat{\tau}_2^c(\lambda = 1)) = \frac{\delta}{1-\delta} \omega(R_0, \tau^*). \quad (\text{A.4})$$

But $\tau^* \in (0, \hat{\tau}_s^c(R_0))$ then implies that $\hat{\tau}_2^c(\lambda = 1) \in (\tau^*, \hat{\tau}_s^c(R_0))$ (see Fig. 1). Thus, the lemma holds for $\lambda = 1$ and $D(\hat{\tau}_2^c(\lambda = 1)) > 0$.

Examining Eq. (18b) and Eq. (9), it is apparent that $\hat{\tau}_2^c(\lambda = 0) = \hat{\tau}_s^c(R_0) > \tau^*$. Thus, $D(\hat{\tau}_2^c(\lambda = 0)) > 0$ is also true, and the lemma holds when $\lambda = 0$.

We next compute $\partial\hat{\tau}_2^c/\partial\lambda$. Since Eq. (18b) holds with equality, this is given by

$$\frac{\partial \hat{\tau}_2^c}{\partial \lambda} = \frac{\partial V_2(\hat{\tau}_2^c; \lambda, \delta, R_0, R_1) / \partial \lambda}{\partial \Omega(R_0, \hat{\tau}_2^c) / \partial \tau_2^c - \partial V_2(\hat{\tau}_2^c; \lambda, \delta, R_0, R_1) / \partial \tau_2^c}. \quad (\text{A.5})$$

The denominator of Eq. (A.5) is negative, since V_2 cuts Ω from below at $\hat{\tau}_2^c$, as Fig. 3 illustrates. It follows that

$$\text{sign} \frac{\partial \hat{\tau}_2^c}{\partial \lambda} = - \text{sign} \frac{\partial V_2(\hat{\tau}_2^c; \lambda, \delta, R_0, R_1)}{\partial \lambda}. \quad (\text{A.6})$$

Using Eq. (18b) and Lemma 1, we find that

$$\frac{\partial V_2(\hat{\tau}_2^c; \lambda, \delta, R_0, R_1)}{\partial \lambda} = \frac{\delta}{(1 - (1 - \lambda)\delta)^2} [\omega(R_1, \hat{\tau}_3^c(R_1)) - \omega(R_0, \hat{\tau}_2^c)], \quad (\text{A.7})$$

from which it follows that

$$\text{sign} \frac{\partial \hat{\tau}_2^c}{\partial \lambda} = - \text{sign} D(\hat{\tau}_2^c). \quad (\text{A.8})$$

Now suppose that $\lambda^\dagger \in (0, 1)$ exists for which $D(\hat{\tau}_2^c(\lambda^\dagger)) = 0$. From Eq. (A.8), it follows that $\hat{\tau}_2^c(\lambda) = \tau^*$ for all $\lambda \geq \lambda^\dagger$. But this contradicts $\hat{\tau}_2^c(\lambda = 1) > \tau^*$. It thus must be that $D(\hat{\tau}_2^c(\lambda)) > 0$ for all $\lambda \in [0, 1]$, which proves Lemma 4. Note also from Eq. (A.8) that $\hat{\tau}_2^c$ decreases in λ . \square

Proof of Proposition 3

Begin with part (iii). Using Lemma 1 and Eq. (16), straightforward calculations reveal that $\hat{\tau}_3^c$ has sign which decreases in δ for $\delta \in (0, \delta^*(R_1))$. Further, $\partial \hat{\tau}_3^c / \partial R_1$ is quadratic in δ and is (i) zero at $\tilde{\delta}(R_1, R_1 - \varepsilon)$ for some small $\varepsilon > 0$, (ii) negative at $\delta = 0$, and (iii) positive at $\delta = 1$. It follows that $\hat{\tau}_3^c$ decreases in R_1 for $\delta \in (0, \tilde{\delta}(R_1, R_1 - \varepsilon))$.

Consider next part (ii). The proof of Lemma 4 establishes that $\hat{\tau}_2^c$ decreases in λ . Arguing as in that proof, it is apparent that $\hat{\tau}_2^c$ decreases in δ , if V_2 increases in δ when τ_2^c is fixed at $\hat{\tau}_2^c$. Calculations reveal that

$$\begin{aligned} \frac{\partial V_2(\hat{\tau}_2^c; \lambda, \delta, R_0, R_1)}{\partial \delta} &= \frac{\lambda \delta / (1 - \delta)}{1 - (1 - \lambda)\delta} \frac{\partial \omega(R_1, \hat{\tau}_3^c)}{\partial \tau_3^c} \frac{\partial \hat{\tau}_3^c}{\partial \delta} \\ &+ \frac{\lambda [1 - \delta^2 (1 - \lambda)]}{(1 - \delta)^2 (1 - (1 - \lambda)\delta)^2} \omega(R_1, \hat{\tau}_3^c) \\ &+ \frac{(1 - \lambda)}{(1 - (1 - \lambda)\delta)^2} \omega(R_0, \hat{\tau}_2^c) > 0. \end{aligned}$$

Thus, $\hat{\tau}_2^c$ declines in δ . Similarly, $\hat{\tau}_2^c$ is increasing in R_1 , since using Lemma 1 and Eq. (A.3),

$$\frac{\partial V_2(\hat{\tau}_2^c; \lambda, \delta, R_0, R_1)}{\partial R_1} = \frac{\lambda \delta / (1 - \delta)}{1 - (1 - \lambda) \delta} \frac{d\omega(R_1, \hat{\tau}_s^c(R_1))}{dR_1} < 0.$$

Consider finally part (i). Using Corollary 1,

$$\begin{aligned} \frac{\partial V_1(\hat{\tau}_1^c; \rho, \lambda, \delta, R_0, R_1)}{\partial \rho} &= \frac{\delta}{(1 - (1 - \rho) \delta)^2} \left\{ \frac{1 - \delta}{1 - (1 - \lambda) \delta} \left[\omega(R_0, \hat{\tau}_2^c) + \frac{\lambda \delta}{1 - \delta} \omega(R_1, \hat{\tau}_3^c) \right] - \omega(R_0, \hat{\tau}_1^c) \right\} \\ &> \frac{\delta}{(1 - (1 - \rho) \delta)^2} \left\{ \frac{1 - \delta}{1 - (1 - \lambda) \delta} \left[\omega(R_0, \hat{\tau}_1^c) + \frac{\lambda \delta}{1 - \delta} \omega(R_0, \hat{\tau}_1^c) \right] - \omega(R_0, \hat{\tau}_1^c) \right\} \\ &= 0, \end{aligned}$$

and so $\hat{\tau}_1^c$ is decreasing in ρ . Next, using Corollary 1 again,

$$\begin{aligned} \frac{\partial V_1(\hat{\tau}_1^c; \rho, \lambda, \delta, R_0, R_1)}{\partial \lambda} &= \frac{\rho \delta}{(1 - (1 - \rho) \delta)(1 - (1 - \lambda) \delta)^2} \\ &\quad \left\{ (1 - (1 - \lambda) \delta) \frac{\partial \omega(R_0, \hat{\tau}_2^c)}{\partial \tau_2^c} \frac{\partial \hat{\tau}_2^c}{\partial \lambda} \right. \\ &\quad \left. + \delta (\omega(R_1, \hat{\tau}_3^c) - \omega(R_0, \hat{\tau}_2^c)) \right\} > 0, \end{aligned}$$

and so $\hat{\tau}_1^c$ decreases in λ .

To evaluate the dependence of $\hat{\tau}_1^c$ on δ , re-write V_1 as

$$\begin{aligned} V_1(\tau_1^c; \rho, \lambda, \delta, R_0, R_1) &= \left[\frac{\rho \delta}{(1 - (1 - \rho) \delta)(1 - (1 - \lambda) \delta)} \right] \left[\omega(R_0, \hat{\tau}_2^c) \right. \\ &\quad \left. + \frac{\lambda \delta}{1 - \delta} \omega(R_1, \hat{\tau}_3^c) \right] + \left[\frac{(1 - \rho) \delta}{1 - (1 - \rho) \delta} \right] \omega(R_0, \tau_1^c). \end{aligned}$$

Calculations reveal that each bracketed term increases with δ , so that V_1 increases with δ . Thus, $\hat{\tau}_1^c$ declines as δ increases. Finally, using Lemma 1 and Eq. (A.3) we have that

$$\begin{aligned} \frac{\partial V_1(\hat{\tau}_1^c; \rho, \lambda, \delta, R_0, R_1)}{\partial R_1} &= \frac{\rho \delta}{1 - (1 - \rho) \delta} \left[\frac{\frac{\partial \omega(R_0, \hat{\tau}_2^c)}{\partial \tau_2^c} \frac{\partial \hat{\tau}_2^c}{\partial R_1} + \frac{\lambda \delta}{1 - \delta} \frac{d\omega(R_1, \hat{\tau}_s^c(R_1))}{dR_1}}{1 - (1 - \lambda) \delta} \right] < 0, \end{aligned}$$

It thus must be that $\hat{\tau}_1^c$ increases in R_1 . \square

References

- Arndt, S.W., 1969, Customs union and the theory of tariffs, *American Economic Review* 59, 108–118.
- Bagwell, K. and R.W. Staiger, 1990, A theory of managed trade, *American Economic Review* 80, 779–795.
- Bagwell, K. and R.W. Staiger, 1993, Multilateral cooperation during the formation of customs unions, NBER Working Paper No. 4543.
- Bagwell, K. and R.W. Staiger, 1997, Multilateral cooperation during the formation of free trade areas, *International Economic Review*, forthcoming.
- Bagwell, K. and R.W. Staiger, 1996, Reciprocal trade liberalization, NBER working paper No. 5488 (National Bureau of Economic Research, Cambridge, MA).
- Baldwin, R., 1987, Politically realistic objective functions and trade policy, *Economics Letters* 24, 287–290.
- Bhagwati, J., 1991, *The world trading system at risk* (Princeton University Press, Princeton, NJ).
- Bond, E.W. and C. Syropoulos, 1996a, The size of trading blocs: Market power and world welfare effects, *Journal of International Economics* 40, 411–437.
- Bond, E.W. and C. Syropoulos, 1996b, Trading blocs and the sustainability of inter-regional cooperation, in: M.B. Canzoneri, W.J. Ethier and V. Grilli, eds., *The new transatlantic economy* (Cambridge University Press, Cambridge).
- Dam K.W. 1970, *The GATT: Law and international economic organization*. (The University of Chicago Press, Chicago, IL).
- Deardorff, A. and R. Stern, 1994, Multilateral trade negotiations and preferential trading arrangements, in: A. Deardorff and R. Stern, eds., *Analytical and negotiating issues in the global trading system* (University of Michigan Press, Ann Arbor, MI).
- Herter, C., 1961, Statement before the Joint Economic Committee of the Congress of the United States, December 4–14, pp. 8–13.
- Kemp, M.C., and H. Wan Jnr, 1976, An elementary proposition concerning the formation of customs unions, *Journal of International Economics* 6, 95–97.
- Kowalczyk, C., 1990, Welfare and customs unions, NBER working paper No. 3476 (National Bureau of Economic Research, Cambridge, MA).
- Kowalczyk, C. and T. Sjostrom, 1994, Bringing GATT into the core, *Economica* 61, 301–317.
- Kowalczyk, C. and R. Wonnacott, 1991, Substitute and complement trading clubs, Working Paper No. 91–16, Department of Economics, Dartmouth College, UK.
- Krugman, P.R., 1991, Is bilateralism bad?, in: E. Helpman and A. Razin, eds., *International trade and trade policy* (MIT Press, Cambridge, MA) 9–23.
- Levy, P.I., 1997, A political-economic analysis of free trade agreements, *American Economic Review*, forthcoming.
- Ludema, R., 1992, On the value of preferential trade agreements in multilateral negotiations, Unpublished Manuscript.
- Viner, J., 1950, *The customs union issue* (Carnegie Endowment for International Peace, New York).
- WTO (World Trade Organization), 1995, *Regionalism and the world trading system*, Geneva.