Trade Liberalization and Trade Adjustment Assistance*

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Revised: August 1994

* We thank Bill Ethier and participants in CEPR's Conference on The New Transatlantic Economy for helpful comments, and our discussant Costas Syropoulos for especially detailed and helpful suggestions and for pointing out an error in an earlier draft.

Abstract

We explore the relationship between trade adjustment subsidies and successful reciprocal trade liberalization. We consider economies that are faced with a periodic need to move resources out of a declining import-competing sector, and that are attempting to sustain cooperative but self-enforcing trade agreements in the face of these adjustment needs. If the limitations associated with enforcement of international trade agreements are sufficiently severe, trade adjustment assistance can facilitate reciprocal trade liberalization. We argue that this suggests a possible efficiency rationale for adjustment policies that treat resources differently when traded sectors are involved.

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I. Introduction

Successive rounds of multilateral trade negotiations under the General Agreement on Tariffs and Trade (GATT) have been important for Transatlantic economic relations over the post-war period. The prospects for continued progress seem unsure, however, as multilateral trade liberalization has encountered increasingly rough sailing over the past several decades. It is therefore important that alternative policy tools and initiatives be evaluated with regard to their potential for fostering greater success in multilateral trade liberalization. In this paper, we explore the potential for trade adjustment assistance to serve this role.

The provision of trade adjustment assistance poses an interesting puzzle in its own right. A program of adjustment assistance to trade-impacted import-competing sectors in an amount over and above what is normally available to displaced resources was first introduced into United States law in the Trade Expansion Act of 1962. Trade Adjustment Assistance (TAA) in some form has been a part of U.S. trade law ever since. Nor is U.S. law unique in this regard; many countries offer some form of special assistance to trade impacted resources, and such programs have been interpreted as consistent with the "escape clause" (Article XIX) of GATT. More recently, however, the prospect of offering special benefits to workers displaced for trade-related reasons has come under renewed scrutiny. While U.S. policy seems to be moving *away* from providing trade-impacted workers with special programs on the grounds that there is no basis for treating such workers differently from other displaced workers, Bhagwati (1988) has argued for *strengthening* trade adjustment assistance programs as a key area of unilateral and multilateral reform. Since the rationale for trade adjustment assistance rests on the case for treating trade-impacted workers differently from other displaced workers within the context of a broader adjustment program, a crucial question in this debate is why trade-impacted import-competing resources might be deserving of special treatment.

An important component of the answer to this question may be that adjustment assistance offered to trade-impacted import-competing workers can facilitate trade liberalization. This interpretation is suggested by the legislative history of TAA in the United States. Before 1962, the United States relied solely on authority provided under GATT's Article XIX to temporarily raise tariffs from GATT-negotiated levels in the event that negotiated tariff reductions threatened import-competing industries with serious injury. However, the right to reverse negotiated tariff reductions through these "escape clause" proceedings bred skepticism among U.S. trading partners concerning the U.S. commitment to lower trade barriers negotiated under GATT (see, for example, Preeg, 1970, p.48). By providing the United States with an alternative to escape clause proceedings which was more acceptable to its trading partners, the introduction of TAA in the Trade Expansion Act of 1962 was to provide U.S. trading partners with additional assurance that tariff reductions negotiated under the Kennedy Round would not later simply be undone.

We explore in this paper the possibility that trade adjustment assistance can facilitate reciprocal trade liberalization. Our basic observation is that there may well be strategic benefits associated with a worker's decision to exit a trade-impacted sector when countries are engaged in a process of reciprocal trade liberalization but are restricted to self-enforcing agreements, and that adjustment assistance to facilitate relocation outside the sector can internalize these externalities. In this paper, we focus on an externality that is essentially static, reflecting the static misallocation of resources across sectors that is brought about by the presence of tariffs. Specifically, a program of trade adjustment assistance introduced by one country as part of a broader cooperative trade agreement can reduce the distrotionary costs of its trading partner's remaining tariffs under the agreement, increasing the value to the trading partner of maintaining the integrity of the agreement, and thereby tempering enforcement problems. If each country implements such a program, enforcement problems associated with maintaining international cooperation are symmetrically relaxed, and tariffs can be symmetrically lowered as a consequence. This is the basic message of the paper.

Our approach to distinguishing trade-impacted import-competing industries from the rest of the economy for purposes of adjustment policy is related in spirit if not methodology to a view of trade adjustment assistance associated with the political economy literature (see, for example, Richardson, 1982), which focuses on the ability to secure protective trade policies as the distinguishing feature of import-competing sectors.[1] According to this view, trade adjustment assistance can be thought of as a bribe offered to the import-competing sector in return for "good behavior," i.e. going along with liberal trade policies. By making possible the reduction of tariffs at home, domestic trade adjustment assistance will also help to bring about tariff reductions abroad through a process of reciprocal tariff concessions. It is the latter which is presumably the major source of national welfare gains to a country that introduces a program of trade adjustment assistance.

In this paper, rather than focusing on the conflicting interests *within* countries as to the determination of trade policy, and on how trade adjustment assistance can affect the outcome of this *domestic* conflict, we focus on the trade policy conflicts *between* countries and on how trade adjustment assistance can affect the outcome of this *international* conflict. In agreement with the political economy view, we find that trade adjustment assistance can serve as a bribe for cooperative behavior. However, we find that the bribe embodied in trade adjustment assistance accrues directly to *foreign* interests, and is contingent on the continuation of liberal *foreign* trade policies. In essence, each country's trade adjustment assistance program expands the tax base for tariff revenue collected by its trading partner, but is only made available as long as trading-partner tariffs remain at a low cooperative level. Thus, each country's program of trade adjustment assistance rewards cooperative tariff behavior by its trading partners, allowing greater tariff cooperation and higher welfare to be achieved by all countries in equilibrium as a result.

We begin in Section II by introducing a simple model of resource adjustment in response to trade shocks. We solve for the most-cooperative tariffs sustainable in the absence of trade adjustment assistance. Section III explores the impact of a program of trade adjustment assistance on equilibrium tariffs and welfare. Section IV concludes.

II. A Model of Sectoral Adjustment

II.1 Basic Assumptions

We begin by describing the basic model in the absence of trade adjustment assistance. We will consider economies that are faced with a periodic need to move resources out of a declining sector, and that are attempting to sustain cooperative but self-enforcing tariff levels in the face of these adjustment needs. Institutionally, one might think of the self-enforcing cooperative tariff levels as those codified in GATT, of the temporary tariff response to protect declining sectors as consistent with that provided for under the escape clause, and of the use of trade adjustment assistance as an alternative government response which can be used in conjunction with temporary protection.[2]

Specifically, we consider two economies, home (no *) and foreign (*), that trade with each other in the products of an infinite sequence of a pair of one-period-lived industries. One of the industries in each country (industry x abroad and industry y at home) has a stable technology over the period. However, the other industry (industry y abroad and industry x at home) is a "sunrise" industry, with its rise and decline corresponding to two distinct industrial phases within the period. Each period begins with a "sunrise" phase, during which each country has a strong productivity advantage relative to the other country in its sunrise industry, and ends with a "sunset" phase in which this productivity advantage erodes. We assume that each country is also endowed with a traded numeraire good which enters linearly into utility and is consumed in positive amounts by both countries, and therefore restrict our analysis to a partial equilibrium setting.

We assume that in each country and in each period, there is a fixed amount of labor (one unit) to be allocated across production in the two industries, x and y. For simplicity, all consumption occurs at the end of each period, so there is no need to discount within period activities, i.e. between phases one and two.[3] Production technologies for x and y in the home and foreign country are given by

$$Q_x = v_0 L_x; \quad Q_y = L_y; \quad Q_x^* = L_x^*; \quad Q_y^* = v_0 L_y^*$$

in the sunrise phase and by

$$Q_x = vL_x; \quad Q_y = L_y; \quad Q_x^* = L_x^*; \quad Q_y^* = vL_y^*$$

in the sunset phase, with Q_i and L_i denoting output and employment in sector $i\varepsilon\{x,y\}$, and where $v_0 > 1$ and $v\varepsilon(0,1)$.

Thus, in the sunrise phase of any period, the home (foreign) country has a relative productivity advantage in x (y), while in the sunset phase this productivity advantage is reversed. For simplicity, we assume that both v_0 and v are completely deterministic and known at the time of initial labor allocation. Domestic demand for x and foreign demand for y are taken to be infinitely elastic at $P_x = P^*_y = 1$, while there is no demand for y at home or for x abroad. Thus, each country consumes only the numeraire good and its sunrise good, and local prices of both goods consumed in each country are fixed at unity. These artificial demand assumptions allow us to focus on the supply-side of the model, where the resource movements that are central to trade adjustment assistance can be isolated. Under our assumptions on demand, if trade occurs, x will be imported by the home country at a domestic price of unity and y will be imported by the foreign country at a foreign price of unity. Henceforth, we will refer to industry x abroad and y at home as the "export sector" of the respective country.

Each country can set trade taxes at the beginning of each phase. The demand assumptions assure that export taxes are never advantageous, since the incidence of such taxes would fall completely on the exporters. For any (specific) domestic import tariff τ_x and foreign import tariff τ^*_y, the respective exporting country prices are given by

$$P^*_x(\tau_x) = 1 - \tau_x; \quad P_y(\tau^*_y) = 1 - \tau^*_y.$$

At the beginning of the first (sunrise) phase of any period in a given country, workers must make an initial (costless) decision about whether to locate in industry x or y. The location decision is made to maximize expected labor income over the period. Once allocated, workers produce in their chosen industry during the sunrise phase and then, at the beginning of the period's sunset phase, are free to change jobs for sunset-phase production. However, they face a cost in moving between x and y. In particular, a worker of type λ who moves between x and y at the beginning of the sunset phase of the period spends the amount λ on moving costs. These moving costs vary across individuals, and embody the real resources of a moving industry in the rest of the economy that turns numeraire goods into moving services with a linear technology. For simplicity, we take worker types (and thus λ) to be distributed uniformly on the unit interval.

In either phase, workers are hired by each industry up to the point where the industry wage equals the value of labor's marginal product. The equilibrium labor hiring conditions imply

$$w_{x0} \geq v_0; \quad w_{y0} \geq 1 - \tau^*_{y0}; \quad w^*_{x0} \geq 1 - \tau_{x0}; \quad w^*_{y0} \geq v_0$$

in the sunrise phase, and

$$w_x \geq v; \quad w_y \geq 1 - \tau^*_y; \quad w^*_x \geq 1 - \tau_x; \quad w^*_y \geq v$$

in the sunset phase, with equalities holding for any industry in which employment is strictly positive in that phase. Thus, provided employment in each industry is strictly positive, the wage paid to workers in the sunrise industry falls in the sunset phase as productivity falls to v, while the wage paid to workers in the export industry is declining in the tariff the industry faces on its sales abroad. Here and throughout, "0" subscripts denote sunrise phase values.

II.2 Labor Allocation in the Sunrise Phase

We now establish conditions under which, in the sunrise phase of each period, workers choose to locate in the sunrise industry in each country. With this initial allocation, we then study the incentive for workers to reallocate out of the industry in its sunset phase. It is with respect to this labor reallocation that we will later consider the role of trade adjustment assistance.[4]

Consider for a moment the location decision in the sunrise phase for workers of type $\lambda=1$. These are workers for whom moving out of the sunrise industry as its productivity erodes in the sunset phase is not worthwhile; by staying, such a worker avoids moving costs and gets $v>0$ in the second phase, while by leaving the domestic (foreign) worker would receive $-\tau^*_y \leq 0$ ($-\tau_x \leq 0$). Thus, a worker of type $\lambda=1$ will be the least likely of all types to choose to locate initially in the sunrise industry since, for such a worker, locating in the sunrise industry implies staying there during the sunset phase.

To establish conditions under which all workers choose initially to locate in the sunrise industry of their country in any period, we thus need only establish when a worker of type $\lambda=1$ would choose to do so. Note that a worker of type $\lambda=1$ who locates initially in the sunrise industry of his country will receive a wage over the period of $v_0 + v$. Alternatively, such a worker who chooses to locate initially in the export sector (and stay there) would receive a wage over the period of $2 - (\tau^*_{y0}+\tau^*_y)$. Since this amount is no greater than 2 (for non-negative tariffs), all labor will choose to locate initially in the sunrise industry of each country in each period provided that

$$v_0 + v > 2$$

a condition that we assume is met. In words, we require that the productivity advantage for the sunrise industry in its sunrise phase be sufficiently great relative to its future decline. Hence, under this condition, each country will be specialized in the production of its sunrise industry in the sunrise phase (home specializes in x and foreign specializes in y), and there is no trade in either good. Accordingly, first-phase tariff policy is irrelevant, and we simply set $\tau_{x0}=\tau^*_{y0}=0$.

II.3 Labor allocation in the Sunset Phase

Now consider the relocation decision of workers at the beginning of the sunset phase of the period. Workers with lower λs (lower moving costs) will be the first to leave the sunrise industry as it enters its sunset phase, with the marginal moving worker in each country given by

$$\tilde{\lambda}(v;\tau^*_y) = w_y - w_x = 1 - \tau^*_y - v; \quad \tilde{\lambda}^*(v;\tau_x) = w^*_x - w^*_y = 1 - \tau_x - v.$$

The equilibrium allocation of labor in the sunset phase of the period and associated sunset-phase production is, under the uniform distribution of worker types (λs), then given by

$$L_x(v;\tau^*_y) = v + \tau^*_y; \quad Q_x(v;\tau^*_y) = vL_x(v;\tau^*_y)$$

$$L_y(v;\tau^*_y) = 1 - \tau^*_y - v; \quad Q_y(v;\tau^*_y) = L_y(v;\tau^*_y)$$

for the domestic country and by

$$L^*_y(v;\tau_x) = v + \tau_x; \quad Q^*_y(v;\tau_x) = vL^*_y(v;\tau_x)$$

$$L^*_x(v;\tau_x) = 1 - \tau_x - v; \quad Q^*_x(v;\tau_x) = L^*_x(v;\tau_x)$$

for the foreign country, with total moving costs incurred by domestic and foreign labor, respectively, given by

$$M(v;\tau^*_y) = [L_y(v;\tau^*_y)]^2/2; \quad M^*(v;\tau_x) = [L^*_x(v;\tau_x)]^2/2.$$

Finally, domestic and foreign tariff revenue are given, respectively, by

$$T(v;\tau_x) = \tau_x Q_x^*(v;\tau_x); \quad T^*(v;\tau_y^*) = \tau_y^* Q_y(v;\tau_y^*).$$

Figure 1 illustrates the equilibrium sectoral allocation of labor in the sunset phase for the domestic country as a function of the foreign tariff choice. With labor measured on the horizontal axis and starting from the initial sunrise phase allocation in which all of the (one unit) of labor is located in the sunrise sector *x*, the value of labor's marginal product in the import-competing sector *x* in the sunset phase is given by the horizontal line drawn at *v,* while its value if located in the export sector *y*, facing a sunset phase import tariff abroad of τ_y^*, is given by the horizontal line through $1-\tau_y^*$. With labor ordered along the horizontal axis in order of decreasing moving costs, the wage earned in the export sector by each worker after its moving costs have been netted out is then given by the 45 degree line through the point $(1, 1-\tau_y^*)$. The equilibrium allocation of labor remaining in the import competing sector is then determined to be $L_x(\tau_y^*)$ where, net of moving costs, the marginal worker earns *v* regardless of his location choice.

We define per-period welfare for each country as the surplus generated in the two sectors over the period. Because consumer surplus is zero, this amounts to the sum of producer surplus (which is simply the value of production at local prices) associated with production in the sunrise phase (denoted for the domestic country by W_0 and for the foreign country by W^*_0) plus producer surplus and tariff revenue minus labor moving costs in the sunset phase. Thus, each government's respective per-period welfare function is defined by

$$\overline{W}(v;\tau_x,\tau_y^*) = W_0 + Q_x(v;\tau_y^*) + P_y(\tau_y^*)Q_y(v;\tau_y^*) + T(v;\tau_x) - M(v;\tau_y^*)$$

$$\overline{W}^*(v;\tau_x,\tau_y^*) = W_0^* + P_x^*(\tau_x)Q_x^*(v;\tau_x) + Q_y^*(v;\tau_x) + T^*(v;\tau_y^*) - M^*(v;\tau_x)$$

II.4 Non-cooperative Tariffs

We first consider the optimal tariffs that are set when countries do not attempt to cooperate. These will serve both as a benchmark from which to measure the gains from tariff cooperation, and as credible (subgame perfect) threats that can be used to support cooperation in the infinitely-repeated tariff game to be studied next.

As noted above, since there is no trade between the two countries in these two industries in the sunrise phase of any period, tariffs in the sunrise phase are irrelevant. The first and second order conditions of the domestic and foreign welfare functions defined above yield the non-cooperative Nash equilibrium tariffs to be applied at the beginning of the sunset phase in each period. In fact, each country's optimal tariff choice is independent of the choice of its trading partner (i.e., tariff reaction curves are flat), due to our partial equilibrium focus and the fact that we have ruled out export taxes. Assuming that workers reallocate after observing tariff choices,[5] the non-cooperative Nash tariffs are given by

$$\tau_x^N = \tau_y^{*N} = (1-v)/2.$$

Thus, the greater the sunset-phase productivity decline in each country's import-competing sector, the greater the Nash tariff response to the resulting surge in each country's imports. This simply reflects the fact that, when productivity declines in a country's import-competing sector, labor is induced to relocate into the export sector, increasing the underlying free trade volume of exports (1-v) and, with export supply linear in price, reducing the export supply elasticity. Hence, a productivity decline in one's import-competing sector is associated with the relocation of labor toward the export sector, a greater volume of exports as a result, and rising non-cooperative tariffs abroad in response to the export surge and associated fall in export supply elasticity.

Finally, it is direct to show that each country would prefer the maintenance of (symmetric) free trade throughout the sunset phase of each period ($\tau_x = \tau^*_y = 0$) to the non-cooperative Nash tariff outcomes of the sunset phase described above. In fact, for symmetric tariff levels $\tau_x = \tau^*_y = \tau$ we have

$$d\overline{W}(v; \tau_x = \tau, \tau^*_y = \tau)/d\tau = d\,\overline{W}^*(v; \tau_x = \tau, \tau^*_y = \tau)/d\tau = -\tau$$

which is strictly negative for $\tau > 0$. Hence, both countries would monotonically prefer symmetric reductions of their sunset-phase tariffs in the direction of free trade, but the non-cooperative Nash equilibrium has both countries imposing strictly positive symmetric tariffs during this phase in each period and suffering the consequent per-period welfare loss. The tariff reaction curves and Nash equilibrium tariff in the sunset phase are illustrated in Figure 2, along with the per-period welfare levels associated with symmetric free trade, unilateral optimal tariff setting, and the Nash tariff equilibrium. While extremely stylized and simple, the model therefore captures an environment in which intersectoral resource movements and tariff policy interact in a Prisoner's Dilemma setting.

II.5 Cooperative Tariffs

We now consider attempts by the two countries to move cooperatively away from the non-cooperative Nash tariff equilibrium of the sunset phase toward the maintenance of more liberal sunset-phase trade policies. We restrict our attention to agreements in which both countries set a symmetric and stationary sunset-phase tariff τ^c below τ^N, with the agreement held in force by the credible (subgame perfect) threat to forever revert to τ^N if any party defects from the cooperative agreement. While the multiplicity of such equilibria is well known, we focus on the "most-cooperative" equilibrium tariff, i.e., the lowest non-negative tariff, sustainable by this threat, denoted by $\hat{\tau}^c$. This is a natural focus in this context, both because GATT may be viewed as a coordinating vehicle to help countries achieve this equilibrium (see, for example, Bagwell and Staiger, 1990), and because our ultimate interest is in exploring the role that trade adjustment assistance plays in increasing the extent of tariff cooperation achievable by countries. We choose to focus on equilibria supported by Nash reversion rather than other, possibly more severe, punishments (such as the optimal symmetric punishments of Abreu ,1986, 1988) because of the simplicity of Nash punishments and because we believe that our results on the role of trade adjustment assistance are robust to other punishments.

In sustaining a symmetric cooperative tariff τ^c below τ^N , countries must ensure that the one-time pay-off to each country in deviating from τ^c is no greater than the discounted value of avoiding the non-cooperative trade war that would follow a deviation. This is the basic incentive constraint that will determine the degree of sustainable tariff cooperation in the sunset phase of each period. Since countries are completely symmetric and the model is stationary (each period is like every other), we characterize this incentive constraint from the domestic country's point of view and from the vantage point of a representative period.

We first define the one-time payoff in defecting from a cooperative tariff, τ^c, for the domestic country:

$$\Omega(v;\tau^c) \equiv \overline{W}(v;\tau_x=\tau^N,\tau_y^*=\tau^c) - \overline{W}(v;\tau_x=\tau^c,\tau_y^*=\tau^c) = T(v;\tau_x=\tau^N) - T(v;\tau_x=\tau^c)$$

$$= (\tau^N - \tau^c)^2.$$

Hence, the one-time payoff from defection is measured by how far cooperative tariff revenues (those collected under τ^c) are from individually optimal (non-cooperative) tariff revenues (those collected under τ^N) . However, a defection would bring the end of cooperation and the beginning of a trade war. The per-period value of maintaining cooperation at τ^c and avoiding a trade war is given by:

$$\omega(v;\tau^c) = \overline{W}(v;\tau_x=\tau^c,\tau_y^*=\tau^c) - \overline{W}(v;\tau_x=\tau^N,\tau_y^*=\tau^N)$$

$$= [(\tau^N)^2 - (\tau^c)^2]/2.$$

Defining δ as the discount factor and $\Delta \equiv \delta/(1-\delta)$, the incentive constraint which ensures that τ^c will be self-enforcing is

$$\Omega(v;\tau^c) \leq \Delta\omega(v;\tau^c).$$

Figure 3 depicts $\Omega(v;\tau^c)$ and $\Delta\omega(v;\tau^c)$ as a function of τ^c. As the figure depicts, $\Omega(v;\tau^c)$ is decreasing and convex in τ^c for $\tau^c\, \varepsilon[0,\tau^N]$, equal to $(\tau^N)^2$ when $\tau^c=0$ and equal to zero when $\tau^c=\tau^N$. On the other hand, $\Delta\omega(v;\tau^c)$ is decreasing and concave in τ^c, equal to $[\Delta(\tau^N)^2]/2$ when $\tau^c=0$ and equal to zero when $\tau^c = \tau^N$. Figure 3 illustrates the determination of the most cooperative tariff $\$$, which is the lowest non-negative tariff satisfying the incentive constraint, for the case of $\Delta \varepsilon (0,2)$. In the figure, this is determined by the (lowest) point of intersection of $\Omega(v;\tau^c)$ and $\Delta\omega(v;\tau^c)$. Explicit calculation yields

$$\$ = \tau^N \frac{(2-\Delta)}{(2+\Delta)}.$$

Thus, for $\Delta \geq 2$, free trade is sustainable as a cooperative equilibrium in the presence of a decline in import-competing sectors and the intersectoral resource movements that this decline implies. However, for $\Delta \varepsilon (0,2)$, the decline of import-competing sectors requires a tariff response $\$ > 0$ in the cooperative equilibrium, as free trade can no longer be maintained as an incentive-compatible policy.

III. Trade Adjustment Assistance

In this section we consider the role of a program of trade adjustment assistance. We model trade adjustment assistance as a program which offers a relocation subsidy to displaced workers in the sunset phase in proportion to their moving costs. We begin by establishing that a program of adjustment subsidies will not raise the welfare level of the country that implements it if it has no effect on equilibrium tariff choices. Hence, there is no rationale in the model for a country to implement its own trade adjustment assistance program unless by doing so it can alter equilibrium tariff choices in the sunset phase. Next, we show that non-cooperative Nash tariffs will be unaffected by a trade adjustment assistance program which takes this form, so that a country has nothing to gain from implementing such an adjustment assistance program when tariffs are set non-cooperatively. We then show that each country does stand to gain *directly* (i.e., with tariffs held fixed) from a trade adjustment assistance program implemented by its trading partner, so that each country would gain under non-cooperative Nash tariff setting if both implemented small symmetric adjustment programs. Finally, we establish that there is an additional *trade liberalization* gain from the implementation of small symmetric adjustment programs when countries set tariffs cooperatively, provided only that the discount factor is below a critical level, and therefore provided only that sunset-phase tariff cooperation absent an adjustment program is sufficiently hindered by weak enforcement abilities at the international level.

Throughout we focus on *small* adjustment assistance subsidies because they can be implemented unilaterally and entail no enforcement mechanisms, i.e., they do not require the threat of future punishments to maintain. While there is no explicit reason in our model for countries to limit themselves to small amounts of adjustment assistance that can be implemented unilaterally and without international enforcement provisions, our focus does conform to the lack of explicit international cooperation with regard to the implementation of trade adjustment assistance programs, as distinct from tariff reduction, that one observes in practice (though see the comments of Syropoulos (this volume) for an extension of our results to the interesting case in which countries enter into self-enforcing agreements over both tariffs and trade adjustment subsidies). At the same time, a focus on small adjustment subsidies serves our purpose of illustrating the formal possibility that trade adjustment assistance can facilitate trade liberalization without explicitly considering the optimal design of such a policy.

III.1 A Potential Role for Trade Adjustment Assistance

As before, we continue to exploit the symmetry of the model and characterize all magnitudes from the domestic country perspective. In a domestic industry to which trade adjustment assistance has been granted, we suppose that displaced workers who relocate into the export sector receive subsidies equal to a fraction of their moving costs. Thus, the moving cost faced by a domestic worker of type λ who moves from x to y at the beginning of the sunset phase of x is now $(1-s)\lambda$, with $s\varepsilon[0,1]$ denoting the adjustment subsidy rate. Hence, in the presence of trade adjustment assistance, the marginal mover in the domestic country equates the wage in x to the wage received in y net of the unsubsidized portion of his moving costs, or

$$w_x = w_y - (1-s)\tilde{\lambda}.$$

This yields an expression for the marginal moving worker in the presence of trade adjustment assistance of

$$\tilde{\lambda}(v;\tau_y^*, s) = \frac{1-\tau_y^* - v}{(1-s)}.$$

The equilibrium allocation of domestic labor in the sunset phase of the period under a program of domestic trade adjustment assistance and the associated sunset-phase production is then given by

$$L_x(v;\tau_y^*, s) = \frac{v + \tau_y^* - s}{(1 - s)}; \quad Q_x(v;\tau_y^*, s) = vL_x(v;\tau_y^*, s)$$

$$L_y(v;\tau_y^*, s) = \frac{1 - \tau_y^* - v}{(1 - s)}; \quad Q_y(v;\tau_y^*, s) = L_y(v{:}\tau_y^*, s)$$

with magnitudes for the foreign economy defined symmetrically. The total moving costs incurred by the domestic economy, a portion of which is now financed by the trade adjustment assistance program, is then

$$M(v;\tau_y^*, s) = [\, L_y(v;\tau_y^*, s)\,]^2 / 2$$

with domestic tariff revenues given by

$$T(v;\tau_x, s^*) = \tau_x Q_x^*(v;\tau_x, s^*).$$

All other domestic and foreign variables are as before. Finally, since the direct impact of domestic trade adjustment assistance subsidies is simply a transfer from the government to the domestic private sector, domestic and foreign welfare under a program of domestic trade adjustment assistance are defined as before and given by

$$\overline{W}(v;\tau_x,\tau^*_y,s,s^*) = W_0 + Q_x(v;\tau^*_y,s) + P_y(\tau^*_y)Q_y(v;\tau^*_y,s)$$

$$+\, T(v;\tau_x,s^*) - M(v;\tau^*_y,s)$$

$$\overline{W}^*(v;\tau_x,\tau^*_y,s,s^*) = W^*_0 + P^*_x(\tau_x)Q^*_x(v;\tau_x,s^*) + Q^*_y(v;\tau_x,s^*)$$

$$+\, T^*(v;\tau^*_y,s) - M^*(v;\tau_x,s^*).$$

Now consider the impact of a small program of domestic adjustment assistance on domestic welfare. For fixed tariffs, it is direct to calculate that

$$\partial\overline{W}(v;\tau_x,\tau^*_y,s^*,s=0)/\partial s = 0$$

and symmetrically for the foreign country. Thus, absent any effect of the adjustment program on equilibrium tariffs, there is nothing to be gained by either country from implementing its own adjustment assistance program. This is because, for fixed tariffs and therefore fixed domestic prices, and from the point of view of national welfare, a country's workers allocate efficiently across the two sectors in the sunset phase.

Second, note that the non-cooperative Nash tariffs are unaffected by an adjustment program of this form, since export supply elasticities are not affected. That is , we have τ^N defined by

$$\partial\overline{W}(v;\tau_x=\tau^N,\tau^*_y,s,s^*)/\partial\tau_x = \partial T(v;\tau_x=\tau^N,s^*)/\partial\tau_x$$

$$=(1-v-2\tau^N)$$

so that

$$\tau^N(s,s^*) = (1-v)/2 = \tau^N$$

and similarly for the foreign country. Thus, in the non-cooperative Nash equilibrium, equilibrium tariffs are independent of the adjustment subsidies. This simply reflects the fact that we have modeled trade adjustment assistance in a way that leaves export supply elasticities, and hence optimal non-cooperative Nash tariffs, unaffected. This is, of course, not general, but it serves as a useful benchmark from which to evaluate the role of trade adjustment assistance when countries set tariffs under a (self-enforcing) cooperative agreement. In particular, with Nash tariffs unaffected by the program of trade adjustment assistance, we have

$$d\overline{W}(v;\tau_x = \tau^N, \tau_y^* = \tau^N, s^*, s = 0)/ds = 0; \;\; d^2\overline{W}(v;\tau_x = \tau^N, \tau_y^* = \tau^N, s^*, s = 0)/ds^2 < 0.$$

That is, neither country would gain from implementing a small trade adjustment program on its own if tariffs are set non-cooperatively.

Nevertheless, even with fixed tariffs, each country does stand to gain from a small adjustment program implemented by its trading partner. For fixed tariffs, the impact on domestic welfare of a small foreign adjustment program is given by

$$\partial\overline{W}(v;\tau_x, \tau_y^*, s^* = 0, s)/\partial s^* = \partial T(v;\tau_x, s^* = 0)/\partial s^*$$

$$= T(v;\tau_x, s^* = 0)$$

which is positive provided the domestic tariff is positive. Thus, even with fixed tariffs, each country can reduce the distortionary cost to the other of the other's own tariff policy by implementing a small trade adjustment assistance program. This is because each country's marginal worker fails to internalize the additional tariff revenue it could generate for the other country were it to locate in the export sector rather than the import-competing sector: Consequently, at no cost to itself, each country can help the other by internalizing this externality with a small adjustment subsidy. This suggests in turn that small symmetric programs of trade adjustment assistance -- implemented along with a cooperative self-enforcing tariff agreement and maintained as long as cooperative tariff polices were maintained -- could increase the benefits to both countries of maintaining a given level of cooperative tariffs under the arrangement, thereby diminishing enforcement problems and allowing greater tariff liberalization. We now explore formally this possibility.

III.2 Trade Adjustment Assistance and Tariff Liberalization

To characterize the impact on equilibrium most-cooperative tariffs of a small symmetric trade adjustment program implemented in each country, we assume that each country offers to subsidize a small fraction $s=s^*=s^c$ of the relocation costs of its trade-displaced workers as long as tariff cooperation continues. More precisely, we assume that (i) along the equilibrium path, and at the beginning of the sunset phase of each period, each government offers a small symmetric relocation subsidy rate s^c to its injured import-competing workers and sets a symmetric cooperative tariff level τ^c, and (ii) if a deviation from s^c or τ^c is observed, then in all future periods countries set the adjustment subsidy rate s to zero and set tariffs at their Nash level τ^N.

In fact, as noted above, although each country derives no direct benefits from its own adjustment assistance program, for small s^c the program carries no social costs either, so that enforcement of each country's obligation to provide a small adjustment subsidy is not an issue. We thus focus again on the incentive constraints associated with the maintenance of τ^c, but now in the presence of a small symmetric adjustment program.

The one-time payoff in defecting from an agreement over τ^c and any s^c is given by

$$\Omega(v;\tau^c, s^c) = \overline{W}(v;\tau_x = \tau^N, \tau_y^* = \tau^c, s = 0, s^* = s^c) - \overline{W}(v;\tau_x = \tau^c, \tau_y^* = \tau^c, s = s^c, s^* = s^c).$$

To find how the one-time payoff in defecting from τ^c is affected by the introduction of a small adjustment subsidy, it is easily checked that

$$\partial\Omega(v;\tau^c, s^c = 0)/\partial s^c \;=\; \Omega(v;\tau^c, s^c = 0) = (\tau^N - \tau^c)^2 > 0 \;\; for \;\; \tau^c \varepsilon [0, \tau^N).$$

Hence, the one-time payoff to defection from τ^c is larger in the presence of a small symmetric adjustment program than in its absence. The reason is that each country's adjustment program expands its export sector, which increases the tax base for its trading partner's tariff collections and makes defection from τ^c to the optimal tariff more tempting. This by itself would suggest that trade adjustment assistance would hinder the ability to maintain low cooperative tariffs during the sunset phase. Note also that

$$\partial^2\Omega(v;\tau^c, s^c = 0)/\partial s^c \partial\tau^c \;=\; \partial\Omega(v;\tau^c, s^c = 0)/\partial\tau^c < 0 \;\; for \;\; \tau^c \varepsilon [0, \tau^N).$$

Thus, the higher the cooperative tariff (i.e., the closer τ^c is to τ^N), the smaller the upward shift in $\Omega(v;\tau^c, s^c{=}0)$ from a small increase in s^c, i.e., the smaller would be the rise in the one-time payoff from defection associated with the introduction of a small program of trade adjustment assistance.

However, defection would trigger a trade war, and it remains to determine the per-period value of maintaining cooperation and avoiding a trade war in the presence of a small trade adjustment assistance program in each country. For τ^c and any s^c, this is given by

$$\omega(v;\tau^c, s^c) = \overline{W}(v;\tau_x = \tau^c, \tau_y^* = \tau^c, s = s^c, s^* = s^c) - \overline{W}(v;\tau_x = \tau^N, \tau_y^* = \tau^N, s = 0, s^* = 0).$$

To find out how the per-period value of maintaining cooperation is affected by the introduction of a small adjustment subsidy, we note that

$$\partial\omega(v;t^c, s^c = 0)/\partial s^c \ = \ \tau^c(2\tau^N - \tau^c)$$

Hence, the per-period benefit of maintaining cooperation at τ^c and avoiding a trade war is also increased with the implementation of small symmetric adjustment assistance programs in each country. This reflects once again the expanded tax base from which cooperative tariff revenues can be collected and the fact that the adjustment program providing this expansion would be forfeited in a trade war. Finally, note also that

$$\partial^2\omega(v;t^c, s^c = 0)/\partial s^c \partial\tau^c \ = \ 2(\tau^N - \tau^c) > 0 \ \ for \ \ \tau^c \varepsilon [0, \tau^N].$$

Thus, the higher the cooperative tariff (i.e., the closer τ^c is to τ^N), the greater the upward shift in $\omega(v;\tau^c, s^c{=}0)$ from a small increase in s^c, i.e., the higher would be the rise in value of maintaining cooperation associated with the introduction of a small program of trade adjustment assistance.

If liberalization is facilitated by a small symmetric program of trade adjustment assistance, then the most-cooperative tariff sustainable under a small symmetric adjustment assistance program must be smaller than that sustainable in the absence of such a program. Since both $\Omega(v;\tau^c,s^c{=}0)$ and $\Delta\omega(v;\tau^c,s^c{=}0)$ are increasing in s^c, establishing conditions under which the most-cooperative tariff $\hat{\tau}^c$

falls with the introduction of a small readjustment subsidy amounts to finding conditions under which

$$\partial\Omega(v{:}\,\hat{\tau}(s^c=0), s^c=0)/\partial s^c \;<\; \Delta\partial\omega(v;\hat{\tau}(s^c=0), s^c=0)/\partial s^c.$$

This condition holds for $\Delta \varepsilon (0,2/\sqrt{3})$. Recalling that $\hat{\tau}(s^c=0)=\tau^N[2-\Delta]/[2+\Delta]$, this implies that a small symmetric program of trade adjustment assistance will facilitate mutually beneficial trade liberalization provided that cooperation in the absence of such a program would yield a most-cooperative tariff in the range $\hat{\tau}\,\varepsilon([(\sqrt{3}-1)/(\sqrt{3}+1)]\tau^N, \tau^N)$.

Figure 4 illustrates the facilitating effect that a small symmetric program of trade adjustment assistance can have on trade liberalization. The most-cooperative sunset-phase tariff sustainable in the absence of trade adjustment assistance is determined by the (lowest) intersection of the $\Omega(v;\tau^c,s^c=0)$ and $\Delta\omega(v;\tau^c,s^c=0)$ functions, depicted by the light curves in Figure 4. This determines $\hat{\tau}(s^c=0)$. For $\Delta \varepsilon (0,2/\sqrt{3})$, the introduction of a small trade adjustment assistance subsidy $\tilde{s}^c$ will shift $\Delta\omega(\bullet)$ up by more than $\Omega(\bullet)$ at $\hat{\tau}(s^c=0)$. Consequently, as Figure 4 depicts, $\hat{\tau}(\tilde{s}^c) < \hat{\tau}(s^c=0)$. Hence, there can be a trade-liberalizing role for a program of trade adjustment assistance, although this role is limited to situations in which cooperation is sufficiently poor absent such a program.

Finally, note that the welfare impacts of the small symmetric trade adjustment program we have considered are composed of two effects. There is a direct effect (holding tariffs fixed) of each country's program on the other's welfare which is strictly positive for any (fixed) positive cooperative tariffs. And there is a trade-liberalizing effect which facilitates joint trade liberalization (and hence has a strictly positive welfare effect) for $\Delta \varepsilon (0, 2/\sqrt{3})$ but which hinders joint trade liberalization (and hence has a strictly negative welfare effect) for $\Delta \varepsilon (2/\sqrt{3}, 2)$. Since free trade is sustainable during the sunset phase in the absence of trade adjustment assistance for $\Delta \geq 2$, this implies that the overall rationale for trade adjustment assistance depends on the degree of tariff cooperation being sufficiently modest in its absence.

IV. Conclusions

We have proposed and formalized a particular view of the way in which trade adjustment assistance can affect an economy. Our focus has been on the ability of trade adjustment assistance to enhance tariff cooperation between countries. By rewarding one's trading partners for cooperative behavior, we have shown that a small symmetric program of trade adjustment assistance can enhance efficiency, leading to greater tariff cooperation, lower tariffs and higher welfare world-wide. In the process, we have also identified two separate potential welfare benefits of trade adjustment assistance; a direct welfare benefit which occurs at fixed tariffs as each country's adjustment program enhances the efficiency with which its trading partner collects tariff revenue, and an indirect welfare benefit that comes with the trade-liberalizing effects of the adjustment program. We have argued that both effects will yield positive welfare benefits provided that tariff cooperation in the absence of an adjustment program is sufficiently modest, but that for sufficiently high levels of cooperation trade liberalization can be hindered by a trade adjustment assistance program and the overall welfare effects of introducing a small program of trade adjustment assistance could be negative.

While we have ignored in this paper many other relevant dimensions of trade adjustment assistance, we close with a number of implications concerning the design of trade adjustment assistance programs that are suggested from our stylized analysis. First, our analysis points to the importance of the overall degree of international cooperation in trade policy as an input into the design of an efficiency-enhancing trade adjustment assistance program. In particular, where international cooperation in trade policy is achieving only modest success, an efficiency argument for trade adjustment assistance can be made, but when cooperative tariffs are sufficiently low, the efficiency role for adjustment assistance is weakened, and efficiency may even be served by an adjustment tax on movements of resources from the import-competing to the export sector rather than a subsidy. Second, our results suggest that the efficiency rationale for trade adjustment assistance does not depend in a fundamental way on the causes of injury to import-competing resources, but rather only on the fact that injury has occurred and resources are exiting the import-competing sector and entering export sectors. This stands in stark contrast to the focus on injury-due-to-increased-imports that characterizes the actual practice of trade adjustment assistance in the United States and elsewhere. In fact, while the model depicts resources flowing from the import-competing to the export sector, the efficiency arguments for adjustment assistance we have considered have more to do with appropriate policy regarding resources moving into export sectors than with resources moving out of import sectors, although in practice the two will often be linked. Third, our results indicate that the efficiency properties of trade adjustment assistance will depend crucially on how such assistance affects the relocation decisions of workers. In this regard, while some elements of the U.S. TAA program are clearly designed to encourage worker relocation, other elements may work to discourage it, and existing empirical evidence regarding the program's effect on relocation is inconclusive (see, for example, Corson, Decker, Gleason, and Nicholson, 1993, pp. 110-112). Thus, while our results are suggestive of an efficiency enhancing role for adjustment policies that treat resources differently when traded sectors are involved, the relation such adjustment polices have to what is actually embodied in trade adjustment assistance programs is less clear.

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Figure 1

Figure 2

Figure 3

Figure 4

1. Other attempts to model the impact of adjustment assistance include Diamond (1982), Mussa (1982), and Neary (1982).

2. Prior to 1974, eligibility for escape clause protection and/or trade adjustment assistance required that negotiated trade "concessions" (tariff reductions) had to constitute a major cause of the rising imports which were themselves the major cause of injury. The Trade Act of 1974 eliminated the so-called "double causality" standard and allowed rising imports from any cause to be considered in the injury determination. The post-1974 law is closer in spirit to the interpretation of temporary protection and adjustment assistance that we have in mind below, although see also note 4.

3. Allowing consumption to occur in each phase of a period would simply necessitate the introduction of a within-period discount factor in addition to the between-periods discount factor that we consider below.

4. In our model, the need for resource reallocation in the sunset phase is generated by a purely domestic (productivity) shock, and workers are not in fact dislocated from the import-competing sector due to increased imports. While existing trade adjustment assistance programs require a link to be established between import increases and injury in order for trade adjustment assistance to be forthcoming, our results suggest that the *cause* of the dislocation is not a crucial part of the rationale for providing workers that are displaced from import-competing sectors with special adjustment

programs. We will return to this point in the concluding section. We also note here that by focusing on the case of complete sunrise-phase specialization in the absence of adjustment assistance, we are abstracting from a potentially important distortion that could accompany the introduction of trade adjustment assistance, namely, its effect on the initial (sunrise-phase) allocation of resources in the economy.

5.Hence, we ignore the time-consistency issues associated with the optimal tariff which were raised by Lapan (1988).