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GATT, DISPUTE SETTLEMENT AND COOPERATION

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ABSTRACT

This paper analyzes GATT and its dispute settlement procedure (DSP) in the context of a supergame model of international trade featuring both explicit and implicit agreements. An explicit agreement, such as GATT, may be violated at some positive cost in addition to retaliatory actions that might be induced by the violation. We interpret this cost as arising from "international obligation," a phenomenon frequently mentioned in the legal literature on GATT. We focus on how international obligation affects two aspects of GATT-DSP: unilateral retaliation and the effect of inordinate delays in the operation of DSP.

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1. Introduction

Post-WWII tariff history is characterized not only by trade liberalization under the General Agreement on Tariffs and Trade (GATT), but also protectionist episodes in which countries suspended tariff concessions (or appeared to violate GATT rules in other ways). In some instances, protectionist episodes have been resolved without resort to GATT legal proceedings, but in over two hundred cases, countries have initiated GATT dispute settlement procedures (DSP) under Articles XXII or XXIII. In this paper we examine a theoretical trade model which incorporates both the trade liberalization and DSP aspects of GATT. We focus on how tariff cooperation is affected by the existence of a legal agreement such as GATT and by the structure of its dispute settlement procedures. Economic models often abstract from these issues, but legal experts make frequent reference to the importance of GATT as a legal obligation. Moreover, governments perceive weaknesses in DSP as the key to enforcement problems in GATT.

Existing studies take several approaches to modeling trade liberalization. In one approach, tariff determination is modeled as a cooperative game in which binding agreements can be made and enforced. This approach is taken by Mayer (1981), Riezman (1982), and Chan (1988) and has the appealing interpretation that reduced tariffs come out of negotiations. The problem with this approach is that although GATT represents a legal obligation, its rules are not directly enforceable in most of its member countries (Hudec (1986, 1990c), Jackson (1979, 1989)).[1] Because of this, Dixit (1987), Bagwell and Staiger (1990), and Riezman (1991) adopt noncooperative approaches to explaining tariffs. These studies examine when

[1]Although GATT rules are legally binding, they are directly enforceable in domestic courts only when they have been incorporated into domestic law. None of the Articles of GATT provide for disputes to be taken to the World Court. See Jackson (1989) on how this relates to the origins of GATT and unsuccessful attempts to set up the International Trade Organization (ITO).

cooperation can be sustained in infinitely repeated tariff games where tariffs are determined noncooperatively (i.e. when zero or low tariffs are the result of implicit cooperation).[2] Low tariff levels are supported along the equilibrium path by the threat of punishing any "cheating" by reverting to "retaliatory" subgame (equilibrium) paths with lower payoffs. Dixit's focus is on free trade as a noncooperative equilibrium, but periods of both high and low tariffs can occur in equilibrium in Bagwell and Staiger (1990) and Riezman (1991). Equilibria in all three games are self-enforcing, so that there is no role for an independent enforcement mechanism or explicit international agreement. Thus they give no insight into the role of GATT as an explicit agreement or the role of GATT DSP.

Only a few tariff models incorporate DSP. Ludema (1990) incorporates the notion of DSP by restricting the equilibria in an infinitely repeated tariff game to be renegotiation-proof. In this game, if a country deviates from the cooperative tariff, any retaliation must be approved by both the deviating and retaliating country. Modeled in this way, DSP has the effect of making potential retaliation less severe than otherwise, so that within any given class of feasible punishments, the lowest supportable equilibrium tariffs are higher than without DSP. Hungerford (1990) incorporates DSP in a model of tariff and nontariff barriers. In his model, countries can punish cheating only by initiating a costly investigation of foreign actions. Because potential punishment is less severe, the equilibria involve higher levels of nontariff barriers than without DSP. Thus DSP has detrimental effects in both studies.

What are the implications of this work for the Uruguay Round? It is clearly unrealistic to think of countries setting up anything like an independent

[2]Baldwin and Clark (1987) examine both cooperative and noncooperative equilibria. Jensen and Thursby (1984) examine implicit cooperation in a finitely-repeated context. Stahl and Turunen-Red (1990) examine cooperation when government policy changes randomly.

enforcement agency, hence any intuition must come from noncooperative models. These models (in particular, those of Ludema and Hungerford) suggest that more cooperation would be forthcoming in GATT if DSP were simply eliminated. This is difficult to believe given the importance negotiators attach to its reform. In both the Tokyo and Uruguay Rounds, most governments claimed that successful negotiations would be contingent on DSP reform[3]. A more likely scenario is that the existing models are too abstract to be useful in evaluating current negotiations.

This paper bridges the gap between the cooperative and noncooperative approaches to trade liberalization. In cooperative models agreements are binding, and hence infinitely costly to violate. One often thinks of these agreements as being explicit, detailed contracts. In noncooperative models, agreements are not binding (and hence may be costlessly violated), but are enforced through the future actions of the involved agents. Often, these agreements are taken to be implicit and noncontractual.

In the pages to follow, we constuct a supergame model of international trade featuring both explicit and implicit agreements. Our "marriage"[4] of the cooperative and noncooperative approaches assumes that an explicit agreement, such as GATT, may be violated at some finite, but positive, cost; this cost is incurred in addition to any change in future actions that might be induced by such a violation. We interpret this cost as arising from "international obligation", a concept familiar to scholars of international law, but to our knowledge, not widely analyzed by

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[3]We have modeled the inclusion or omission of DSP as an exogenous decision, although it could be thought of as a decision made at a pre-supergame stage. The motivation for this approach is that GATT negotiations are conducted in distinct negotiating rounds so that GATT rules adjust slowly to world market conditions; much more slowly then the rapid-paced change in the nature and frequency of trade disputes. Rod Ludema, in suggesting that perhaps decisions regarding the DSP should be viewed as arising endogenously, has pointed out that abolishing DSP would be a time inconsistent policy. However, when explaining the endogenous determination of institutions within this framework, it is not clear to us what time inconsistency means. If the decision to agree upon institutions can itself be subject to trigger-type punishments, then it appears as if the endogenous determination of institutions may become a problem of infinite regress in the endogenous determination of the rules of the game.

[4]We thank Rod Ludema for suggesting this term.

economists. International obligation acts as a cost imposed upon any country violating an explicit international agreement . The cost is incurred regardless of whether such violations are detected or punished.

In section 2 we explain in more detail what is meant by international obligation. In subsequent sections we explore the implications of incorporating international obligation in our noncooperative tariff model. We focus on how international obligation affects two "real world" aspects of GATT-DSP: unilateral retaliation as well as use of the DSP and the effect of inordinate delays in the operation of DSP.

2. International Obligation, GATT-DSP and Retaliation

Although GATT rules are not directly enforceable in domestic courts, they do represent legally binding obligations. To the extent that governments try to settle disputes through GATT-DSP (rather than unilaterally retaliating), it is clear they take this international obligation seriously. As noted above, governments have initiated GATT legal proceedings in over two hundred disputes. Legal experts refer to international obligation as a crucial element in enforcement of GATT rules. For example, Hudec (1990c, pp. 12 and 14) notes.

> True, like the Pope, international law has no army. But the Pope still makes a pretty good living without one. And so does international legal obligation. Governments do respond, not invariably but more than just occasionally. The greater a government's own reliance on the system of international rules in question, the more influence such obligations will have over its conduct... Governments are assuming that enforcement of GATT legal rulings will continue to rely on the twin engines of international obligation and retaliation.

Similarly, Jackson (1989, p. 83) notes

> It is important for the policy advisor, the statesman, or the practitioner to accurately evaluate the real impact of the international rules recognizing that some of those rules do have considerable effect and

> influence on real government and business decisions. For example, despite cynical statements by members of the U.S. Congress that GATT rules are "irrelevant," there are a number of proven instances when congressional committees and their staff members have taken considerable trouble to tailor legislative proposals so as to minimize the risk of a complaint to GATT.

Although international obligation tends to be ignored in economic models, it provides an interesting interpretation for several computational studies. Brown and Whalley (1980) used a general equilibrium model to calculate welfare effects of Tokyo Round tariff cuts. One of their most striking results was that countries gained more from tariff-cutting proposals other than their own. For example, the United States gained more from the Japanese proposal than its own. The EC gained more from any proposal other than its own. Baldwin and Clarke (1987) found similar results in their study of Tokyo Round tariff-cutting proposals. One interpretation of these results is that standard welfare measures don't adequately capture government objectives in setting trade policy. As noted by McMillan (1988), tariff-cutting formulae may have been motivated by employment or industry objectives, rather than aggregate country welfare. Alternatively, if countries take international obligation seriously, they may formulate negotiating proposals with that in mind.

If international obligation plays a role in enforcing GATT rules, it must do so by affecting not only the incentives for countries to violate rules, but also retaliation to apparent violations. The GATT-DSP is clearly intended to provide alternatives to retaliation as an enforcement mechanism. Article XXII allows for consultation among disputing countries, and Article XXIII provides for panels to investigate and rule on alleged violations. Although retaliation can be recommended under Article XXIII procedures, this has occurred only once in GATT history. When disputes are settled through working parties, countries are often encouraged to negotiate settlements. In this case, the disputing parties may agree on some form of retaliation (as in the Japanese leather dispute listed in Table 1 below). In many cases,

however, countries simply agree to terminate the policies in question, or they agree on suitable compensation. This presumably is why previous attempts to model DSP have done so in ways that limit retaliation.

Nonetheless, there is nothing in GATT to prevent retaliation. It is easy to find cases in GATT history where countries retaliate without filing disputes, as well as cases where they file disputes but eventually retaliate because of extraordinary delays in the legal process. Table 1 presents ten cases of U.S. retaliatory actions between 1974 and 1989. All of these cases involved retaliation under U.S. Section 301 law. In half of the cases, the United States retaliated without filing a GATT dispute. In two of these, disputes were filed eventually against the United States for its retaliatory actions. In the Japanese semiconductor case, the United States had increased tariffs on $300 million of imports from Japan in response to alleged Japanese violation of a bilateral semiconductor agreement. In the other case, Brazil filed a dispute in response to U.S. tariff retaliation to alleged inadequate patent protection in pharmaceuticals. In the rest of the cases listed, retaliation occurred after the United States had filed a dispute. In the Japanese leather case, this retaliation was GATT-legal in the sense that it occurred after the panel report and was mutually agreeable to both parties. However, the other cases involved unilateral retaliation before successful completion of the legal process. In the case of wheat flour, a retaliatory subsidy was instituted two months before the panel ruling. In the other cases, the United States retaliated after panel reports were blocked by the European Community.

Notice the contrast between this dispute history and the way DSP has been modeled. Neither Ludema (1990) nor Hungerford (1990) incorporate the type of delay in retaliation that occurs when countries follow GATT-DSP. Moreover, their models do not capture the variety of options countries have taken in settling disputes. In reality, countries have followed GATT-DSP in some cases, while in

others they retaliated quickly to apparent violations, or retaliated when the GATT legal process stalled (either due to delays or blocked reports). These features should be incorporated in any model of DSP since much of the dissatisfaction with GATT-DSP concerns either delays or unilateral retaliation. We shall consider both aspects of DSP in Section 4B.

3. Implicit Cooperation in a GATT-less World

A. The Model

We examine implicit tariff cooperation in an infinitely repeated game. The constituent game is one in which two countries, 1 and 2, choose tariff levels $\tau_i \in [0,\infty)$ to maximize a one-period utility function, $U_i(\tau_i,\tau_j)=E_{\underset{\sim}{\theta}} u_i(\tau_i,\tau_j,\underset{\sim}{\theta})$, where $\underset{\sim}{\theta} = (\theta_1,\theta_2)$ is an unobserved random variable in $\mathbb{R}^2_+$. We abstract from whether this function is an index of aggregate utility (as in Dixit (1987)) or the indirect utility of interest groups that influence tariff policy. We make standard trade-theoretic assumptions on the derivatives of u_i with respect to own and foreign tariffs[5], and on the random variable $\underset{\sim}{\theta}$ in order to ensure the existence of a static best response function $\tau_i(\tau_j)$ that is well-behaved in the sense that the best response functions generate a unique non-autarkic Nash equilibrium in tariffs. Let $U_i^R(\tau_j) = U_i(\tau_i(\tau_j),\tau_j)$ denote country i's static best-response payoff, and let τ_i^N and U_i^N denote the one shot Nash equilibrium tariffs and payoffs for i = 1,2, respectively.

The tariff game is infinitely repeated with per period payoffs denoted by $U_{it}(\tau_{it},\tau_{jt})\equiv E_{\underset{\sim}{\theta}} u_i(\tau_{it},\tau_{jt},\underset{\sim}{\theta}_t)$ where $\underset{\sim}{\theta}_t = (\theta_{1t},\theta_{2t})$ are iid across periods. Taking the other country's supergame strategy as given, each country chooses its strategy to maximize its discounted expected utility,

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[5]That is, each country's utility is increasing in its own tariff given a zero foreign tariff, and each country's utility is decreasing in the foreign tariff.

$$E[\sum_{t=0}^{\infty} \beta^t u_{it}(\tau_{it},\tau_{jt},\underset{\sim}{\theta}_t)] \tag{1}$$

where $\beta<1$ is the common discount factor.

We define a contingent strategy to be an infinite sequence $s_i = (s_{i0},s_{i1},...)$, such that $s_{i0} = \tau_{i0}$ and for $t > 0$, $s_{it} : \mathbb{R}_+^{2t} \times \mathbb{R}_+^{2t} \rightarrow \mathbb{R}_+$. Let S be an arbitrary subset of the set of such contingent strategies, S. s_{it} determines country i's tariff level at time t as a function of the history of tariffs levied by both countries in periods 0,...,t–1 and past realizations of a pair of summary statistics $\omega_{is}(\tau_{1s},\tau_{2s},\theta_{1s},\theta_{2s})$, s = 0,...t–1, i = 1,2. Call the history of past tariffs and summary statistic realizations up to time t, H_t.

One example of such a strategy arises in Riezman (1991) where tariff levels are assumed to be unobservable. In this case country i's period t action is not directly dependent on past tariff levels, but depends only on the observed sequence of country 2 imports, where period t imports are a function of τ_{1t}, τ_{2t}, and $\underset{\sim}{\theta}_t$. Hence the contingent strategies in Riezman are restricted to a set S of strategies that are independent of past tariffs. Another example would arise in a model in which tariffs are observable but the per period utility function arises from a random political process which dictates the weights of various interest groups in determining trade policy. In this case, allowing period t tariffs to be contingent upon $\omega_{it}(\tau_{1t},\tau_{2t},\theta_{1t},\theta_{2t})$, i = 1,2, could represent the dependence of the governments' policies on a random process of political influence.[6]

A contingent strategy pair (s_1^*,s_2^*), determines a stochastic process of summary statistics and tariffs. Denote the expectation of this process by $E_{s_1^*,s_2^*}$. A Nash equilibrium in S is a pair of contingent strategies (s_1^*,s_2^*), $s_i^* \in S$ satisfying.

$$E_{s^*_1,s^*_2}[\sum_{t=0}^{\infty} \beta^t u_{it}(s_{1t}^*(H_t),s_{2t}^*(H_t),\underset{\sim}{\theta}_t)]$$

[6]This is in the spirit of Feenstra and Lewis (1987) where governments face varying degrees of protectionists political pressure at home or Jensen and Thursby (1990) where a random political process influence which interest group's preferences to follow when levying tariffs.

$$\geq E_{s_i, s^*_j} [\sum_{t=0}^{\infty} \beta^t u_{it}(s_{it}(H_t), s^*_{jt}(H_t), \underset{\sim}{\theta}_t)] \qquad \forall s_i \in S \quad i=1,2 \quad j \neq i. \qquad (2)$$

As do Green and Porter (1984) and Riezman (1990), we focus on contingent strategies that involve reverting to the one shot Nash equilibrium for T-1 periods, starting at time t+1 if the observed summary statistic at time t is in a certain set.[7] Specifically let $\underset{\sim}{\omega}_t = (\omega_{1t}(\tau_{1t},\tau_{2t},\theta_{1t},\theta_{2t}), \omega_{2t}(\tau_{1t},\tau_{2t},\theta_{1t},\theta_{2t})) \in \Omega \subset \mathbb{R}^2_+$ trigger such a reversion. We are interested in determining when a profile of low "cooperative" tariffs (τ_1,τ_2) can be supported as an equilibrium choice in "normal" periods by the threat of T-1 period reversion. Define period t to be normal if one of the following holds: (a) t = 0, or (b) t-1 was normal and $\underset{\sim}{\omega}_{t-1} \notin \Omega$, or (c) t-T was normal and $\underset{\sim}{\omega}_{t-T} \in \Omega$. Otherwise t is reversionary.

A pair of tariffs (τ_1,τ_2) that are lower than the one-shot equilibrium tariff levels can be supported in a subgame perfect equilibrium by such a "trigger" strategy if the one-period gain from deviating to a higher tariff does not outweigh the potential loss from increasing the probability of triggering reversion.[8] Let $F(\tau_1,\tau_2)$ be the probability that $\underset{\sim}{\omega}_t(\tau_1,\tau_2,\theta_{1t},\theta_{2t}) \notin \Omega$. Since $\underset{\sim}{\theta}_t = (\theta_{1t},\theta_{2t})$ are iid across periods, F depends only upon the tariff levels set, and is not time dependent. $1-F(\tau_1,\tau_2)$ is the probability that the "punishment" of reverting to the one-shot Nash equilibrium for T-1 periods is imposed. We assume that Ω is chosen in such a way that F is decreasing in τ_i, so that the probability of punishment is increasing in τ_i.

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[7]There is nothing sacred about Nash reversion. Most, if not all of our qualitative insights would apply to a wide range of reversionary strategies. However, non-Nash reversion does make the treatment of demons in Section 3Bii considerably more complicated.

[8]We have ignored here the issue of renegotiation proofness analyzed elsewhere (see Ludema (1990). One implication of incorporating renegotiation is that the ability to credibly punish may be severely restricted, because of the ability to renegotiate away from undesirable subgame perfect equilibria, thereby making initial cooperation more diffucult. While this concept is rather elegant mathematically, we are not sure as to the importance of this phenomenon. Our feeling is that other factors such as revenge, which is more difficult to model mathematically, may tend to bias outcomes in the other direction, allowing punishments not only worse than standard renegotiation proof equilibria, but also subgame perfect equilibria in general. A more thorough treatment of revenge would have to await a more thorough theory of games in which preferences over outcomes depend on the complete game tree itself, as well as the strategies and path followed. In the context of this paper it might suffice to say that a country (or policymaker) may actually derive utility from punishing a "cheater" and hence may have preferences over, say, per period trade flows that are not history independent.

Given this probabilistic punishment, the value to country i from setting a level of protection τ_i given that country j has set τ_j is

$$V_i(\tau_i,\tau_j) = U_i(\tau_i,\tau_j) + (1-F(\tau_i,\tau_j))\{\sum_{t=1}^{T-1}\beta^t U_i^N + \beta^T V_i(\tau_i,\tau_j)\} + \beta F(\tau_i,\tau_j)V_i(\tau_i,\tau_j) \qquad (3)$$

$$i = 1,2,\ j \neq i$$

which, after rearrangement, gives

$$V_i(\tau_i,\tau_j) = \frac{U_i^N}{1-\beta} + \frac{U_i(\tau_i,\tau_j) - U_i^N}{1-\beta^T + F(\tau_i,\tau_j)(\beta^T-\beta)} \qquad (4)$$

An implicitly cooperative agreement (τ_i^c,τ_j^c) is supported as a noncooperative equilibrium by this T-1 period trigger if

$$V_i(\tau_i^c,\tau_j^c) \geq V_i(\tau_i,\tau_j^c) \qquad \forall\tau_i \quad i=1,2,\ j\neq i. \qquad (5)$$

By imposing conditions on the function $F(\tau_i,\tau_j)$ and U_i, we can represent a noncooperative equilibrium as a solution to the pair of first order conditions,

$\frac{\partial V_i}{\partial \tau_i}(\tau_i^c,\tau_j^c) = 0$, i=1,2, j≠i, which can be written as

$$\frac{\partial U_i(\tau_i^c,\tau_j^c)}{\partial \tau_i}[1-\beta^T+F(\tau_i^c,\tau_j^c)(\beta^T-\beta)] + (\beta-\beta^T)[U_i(\tau_i^c,\tau_j^c)-U_i^N]\frac{\partial F(\tau_i^c,\tau_j^c)}{\partial \tau_i} = 0 \qquad (6)$$

$$i=1,2, \quad j\neq i.$$

If the punishment and trigger probabilities support an equilibrium more cooperative than the one-shot Nash equilibrium, the first term is positive because of the static incentive to increase the tariff above τ_i. The second term is negative since F is decreasing in τ_i.[9]

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[9]When first order conditions are not sufficient, the condition (5) reduces to

$$[U_i(\tau_i^c,\tau_j^c)-U_i(\tau_i,\tau_j^c)]\,(1-\beta^T)-(\beta-\beta^T)\,\{[U_i(\tau_i^c,\tau_j^c)-U_i^N]\,F(\tau_i,\tau_j^c)-[U_i(\tau_i,\tau_j^c)-U_i^N]\,F(\tau_i^c,\tau_j^c)\} \geq 0$$

$$\forall\tau_i \quad i=1,2 \quad j\neq i$$

B. Special Cases

(i) $T=\infty$

Suppose that the reversionary periods are grim trigger strategies ($T=\infty$). Then

$$V_i(\tau_i \tau_j) = \frac{U_i^N}{1-\beta} + \frac{U_i(\tau_i,\tau_j) - U_i^N}{1-\beta F(\tau_i,\tau_j)} \tag{7}$$

and the equilibrium conditions are adjusted accordingly.

(ii) Complete Information or Certain Punishment

Suppose $\omega_{it}(\tau_{1t},\tau_{2t},\theta_{1t},\theta_{2t}) = \tau_{it}$, i=1,2, and that the trigger set Ω is the set $\{(\tau_1,\tau_2)\colon \tau_1>\tau_1^c \text{ or } \tau_2>\tau_2^c\}$. Then the model outlined reduces to the complete information trigger strategy model with T-1 period reversion.

(iii) Demons

In the model outlined so far, in equilibrium countries know the tariffs that are set. Whether or not tariffs are observable, countries can deduce tariff levels in equilibrium. If a punishment path is initiated, it is initiated despite the fact that no deviation from the implicitly cooperative tariff occurs. Reversionary periods are triggered by bad realizations of the random variable rather than "cheating" on cooperative tariffs.

In a GATT-less world, such a motivation for reversionary periods is not unduly restrictive. However, many GATT disputes involve panel investigations of whether deviations from tariff bindings are legitimate (for example, in escape clauses actions) or whether they are true deviations from the agreement. In order to analyze the role of DSP in such determinations, the basic model must allow for deviations from cooperative tariffs in equilibrium. One way to do this is to extend the model is to allow reversionary periods to be triggered by a random deviation by one country from the implicitly cooperative tariff level. In this way, the decision to

punish by reverting to the one-shot Nash equilibrium may be the result of a deviation from the implicitly cooperative tariff level (i.e. "cheating") or it may not.

We model these random deviations by borrowing from Segerstrom (1988) the notion of a "demon." We assume that, in each period, with probability $1-\alpha$ country 1 plays a static best response to country 2's equilibrium action for that period. When this happens, country 1 is "possessed (temporarily) by a demon." Of course, when the countries are in a period of reversion to the static Nash equilibrium, the possessed and unpossessed are indistinguishable. We will generally take $1-\alpha$ to be small, representing a small amount of irrationality.

Suppose t_2^c is the proposed implicitly cooperative tariff level of country 2. Country 1's discounted expected utility as a function of its own tariff level, τ_1, becomes

$$V_1(\tau_1, \tau_2^c) = \alpha\, U_1(\tau_1, \tau_2^c) + (1-\alpha)\, U_1^R(\tau_2^c) +$$

$$\alpha[(1-F(\tau_1, \tau_2^c))\{\sum_{t=1}^{T-1}\beta^t U_1^N + \beta^T V_1(\tau_1, \tau_2^c)\} + \beta F(\tau_1, \tau_2^c)\, V_1(\tau_1, \tau_2^c)] \tag{8}$$

$$+ (1-\alpha)[(1-F(\tau_1(\tau_2^c),\tau_2^c))\{\sum_{t=1}^{T-1}\beta^t U_1^N + \beta^T V_1(\tau_1, \tau_2^c)\} + \beta F(\tau_1(\tau_2^c),\tau_2^c)\, V_1(\tau_1, \tau_2^c)]$$

Define

$\mathcal{V}_1(\tau_1) \equiv V_1(\tau_1, \tau_2^c)$, $\mathcal{U}_1(\tau_1) \equiv \alpha\, U_1(\tau_1, \tau_2^c) + (1-\alpha)\, U_1^R(\tau_2^c)$, $\bar{F}(\tau_1) \equiv F(\tau_1, \tau_2^c)$ and $\tilde{F} \equiv F(\tau_1(\tau_2^c),\tau_2^c)$.

Then

$$\mathcal{V}_1(\tau_1) = \frac{U_1^N}{1-\beta} + \frac{\mathcal{U}_1(\tau_1)-U_1^N}{1-\beta^T+(\beta^T-\beta)[\bar{F}(\tau_1)\alpha+\tilde{F}(1-\alpha)]} \tag{9}$$

Country 2 is never possessed with a demon and, hence, for any proposed cooperative tariff pair (τ_1^c, τ_2^c), τ_2^c must maximize.

$$V_2(\tau_1^c, \tau_2) = \alpha\, U_2(\tau_1^c, \tau_2) + (1-\alpha)U_2(\tau_1(\tau_2^c),\tau_2)$$

$$+ \alpha\,[(1-F(\tau_1^c, \tau_2))\{\sum_{t=1}^{T-1}\beta^t U_2^N + \beta^T V_2(\tau_1^c, \tau_2)\} + \beta F(\tau_1^c, \tau_2)V_2(\tau_1^c, \tau_2)] \qquad (10)$$

$$+ (1-\alpha)\,[(1-F(\tau_1(\tau_2^c),\tau_2))\{\sum_{t=1}^{T-1}\beta^t U_2^N + \beta^T V_2(\tau_1^c, \tau_2)\} + \beta F(\tau_1(\tau_2^c),\tau_2)\, V_2(\tau_1^c, \tau_2)]$$

Collecting terms, an expression analogous to (9) may be obtained.

4. The World According to GATT

A. International Obligation

We model international obligation by assuming that countries bear a cost when they deviate from the GATT-determined cooperative tariff levels, (τ_1^g,τ_2^g), in cooperative periods or from GATT specified strategies in reversionary periods. In the political economy interpretation of this model, we can think of this disutility as a loss of goodwill in the international arena or the political embarrassment that comes from being suspected of violations, regardless of whether retaliation is actually triggered. In the imperfect monitoring interpretation of the model, the disutility could be viewed as a domestic political cost or loss of goodwill within an internal circle of policymakers.[10] Finally, as in other human endeavors, this cost could be interpreted simply as the disutility of a "guilty conscience" arising from the violation of an agreement (and incurred even if the violation is undetected).

We examine three possible forms that this disutility might take: (i) A fixed cost c incurred by a country the first time it deviates (with future deviations generating no disutility); (ii) A fixed cost that is incurred after the initial deviation

[10]This latter interpretation, while perhaps less appealing than the political economy interpretation, does not require that other countries observe the violation.

and upon the first deviation after any reversionary period;[11] and (iii) A cost c incurred by a country in every period in which it deviates from GATT-determined tariff levels. Note that if the punishment period is T = ∞, alternatives (i) and (ii) coincide. If punishments are certain,[12] then (ii) and (iii) coincide. In the version of the model with a demon, we shall assume that being a demon means not incurring a cost; that is, demons feel no international obligation.

First we examine a fixed cost, as in case (i), for the basic model without demons. In this case, equation (4) remains as before for $\tau_i = \tau_i^g$, where τ_i^g denotes the GATT-determined cooperative tariff. But for $\tau_i \neq \tau_i^g$

$$V_i^O(\tau_i,\tau_j) = -c + \frac{U_i^N}{1-\beta} + \frac{U_i(\tau_i,\tau_j) - U_i^N}{1-\beta^T + F(\tau_i, \tau_j)(\beta^T-\beta)} \tag{11}$$

Hence, the cost incurred in violating GATT rules simply shifts down the function $V_i(\tau_i,\tau_j)$ for $\tau_i \neq \tau_i^g$, generating a discontinuity in the function at τ_i^g. If the fixed cost is incurred in every period of deviation, as in case (iii), equation (4) remains as before for $\tau_i = \tau_i^g$, but for $\tau_i \neq \tau_i^g$

$$V_i^O(\tau_i,\tau_j) = \frac{U_i^N}{1-\beta} + \frac{U_i(\tau_i,\tau_j) - c - U_i^N}{1-\beta^T + F(\tau_i, \tau_j)(\beta^T-\beta)} \tag{12}$$

Hence, a discontinuity remains at $\tau_i = \tau_i^g$, but the effect on $V_i(\tau_i,\tau_j)$ for $\tau_i \neq \tau_i^g$ is no longer a constant shift down.

These two cost formulations allow us to illustrate an important principle governing the role of GATT-determined tariffs in a world with implicit cooperation. If these tariffs are set too low, international obligation may be ineffective in

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[11] In the event of probabilistic retaliation, deviations that occur after an unpunished deviation incur no cost.

[12] In the imperfect monitoring interpretation of the game, this means information is complete.

achieving lower cooperative tariffs. To illustrate this, suppose that the implicitly cooperative tariff levels in a GATT-less world, (τ_1^c,τ_2^c), are greater than zero. This implies that $V_i(0,0) < V_i(\tau_i,0)$ for some $\tau_i > 0$, as shown in Figure 1. Suppose the GATT-determined tariff level is zero (i.e. $\tau_1^g = \tau_2^g = 0$). In this case, the international obligation induced by GATT may or may not be sufficient to enforce free trade as an implicitly cooperative outcome. Figure 1a depicts a situation where $V_i(0,0) > V_i^o(\tau_i,0)$ $\forall\ \tau_i$, so that free trade can be enforced. In other situations international obligation may not sufficiently reduce the gain from deviating from free trade, and the relevant value functions would be depicted by Figure 1b. In the latter case, there will generally be some tariff level $(\hat{\tau}_1,\hat{\tau}_2)$ lower than the GATT-less implicitly collusive level, (τ_1^c,τ_2^c), which, if specified as the GATT-determined cooperative tariff level, would be immune to deviation. This is depicted in Figure 1c. Hence, a properly chosen GATT tariff can lead to greater cooperation, but attempts to reduce tariff levels too much may lead to cooperative tariff levels no lower than in a GATT-less world.

Indeed, the danger from GATT-determined tariffs being too low is even more striking if international obligation imposes costs in each period (as in case (iii)). In that case, when GATT-determined tariffs are not enforceable, then the existence of GATT-determined obligation may cause the most collusive (implicitly cooperative) tariff levels to increase. For any given tariff of country j,

$$\text{sgn}\quad \frac{dV_i^o(\tau_i,\tau_j)}{d\tau_i} = \tag{13}$$

$$\text{sgn}\quad \left\{ \frac{\partial U_i(\tau_i,\tau_j)}{\partial \tau_i}\left[1-\beta^T + F(\tau_i,\tau_j)(\beta^T-\beta)\right] - \left[U_i(\tau_i,\tau_j)-c-U_i^N\right]\frac{\partial F(\tau_i,\tau_j)}{\partial \tau_i}(\beta^T-\beta) \right\}$$

Hence, for any cooperative tariff level, τ_j, if country i's best response satisfies the first

order condition, $\frac{dV^O(\tau_i,\tau_j)}{d\tau_i} = 0$, totally differentiating this equation yields

$$\text{sgn} \quad (\frac{d\tau_i}{dc}) = \text{sgn} \quad \left(\frac{\partial F(\tau_i,\tau_j)}{\partial \tau_i}(\beta^T-\beta)\right) > 0. \tag{14}$$

An increase in c will cause country i's optimal tariff response to a tariff, τ_j, to increase. Intuitively, the dynamic optimal response $\tau_i^D(\tau_j)$ balances the marginal one-period gain to deviating from the cooperative tariff in a normal period with the expected loss due to the increased probability of triggering a reversionary period. For a given probability of reversion, this loss is reduced (due to the decrease in the payoff from deviating) from $U_i(\tau_i,\tau_j)$ to $U_i(\tau_i,\tau_j)$–c. Hence, the marginal gain from increasing τ_i must be reduced to maintain equality. This is done by setting τ_i at a higher level.

A similar effect occurs in the presence of demons, in which case equation (9) becomes

$$V_1(\tau_1) = \frac{U_1^N}{1-\beta} + \frac{u_1(\tau_1)-\alpha\, c-U_1^N}{1-\beta^T + (\beta^T-\beta)\,[\bar{F}(\tau_1)\,\alpha + \tilde{F}(1-\alpha)]}, \tag{15}$$

where again the cost is as in case (iii). The interpretation of this effect remains the same.

Finally, in the case of infinite horizon grim trigger strategies ($T=\infty$) and certain punishments, the representation of the cost of violating international obligation is simplest. All three cost specifications coincide and GATT-determined tariff levels can be supported if

$$U_i^R(\tau_j^g)-c-U_i(\tau_i^g,\tau_j^g) \;\le\; \frac{\beta}{1-\beta}(U_i(\tau_i^g,\tau_j^g)-U_i^N) \tag{16}$$
$$i=1,2,\ j\neq i.$$

To the extent that international obligation reduces the left-hand side of the inequality, it facilitates tariff cooperation. Of course, if the cooperative tariff pair, (τ_1^g,τ_2^g), is so low that the inequality in (16) does not hold (for given β), then the international obligation of GATT has no effect.

B. The Dispute Settlement Procedure

Essential to the proper working of any agreement is an understanding as to how disputes arising from the agreement's provisions will be resolved. In international agreements such as GATT, which are not enforced by outside institutions, disputes are often resolved through negotiation between the parties and threats of unilateral actions to back up a country's demands.

It seems reasonable to justify the inclusion of a dispute resolution procedure in GATT by claiming that it would be difficult for any government to feel international obligation if there were no such procedure. Having demonstrated the benefits of international obligation it seems evident then that the existence of a DSP is easily explained. In this section we ask how the characteristics of such a procedure might enhance or hinder international cooperation. Given the observed deficiencies in the DSP, it seems worthwhile to focus on two particular issues: the problem of delay until punishment and the inability of the mechanism to properly identify actual deviations from GATT policy.

We deal first with the former. It is clear that in the context of our model any mechanism that delays punishment or retaliation makes it more difficult to support low tariff levels in a cooperative outcome.[13] This is because, in equilibrium, the one-period gain from cheating on cooperation is balanced by the potential loss from triggering reversion. If reversion occurs with delay, not only is its cost lowered (due

[13]See Abreu, Milgrom and Pearce (1991) for an example of a model in which this may not hold.

to discounting), but also the deviating country may be able to benefit from its deviation for a longer period.

To assess the effect of this delay, we look first at the model with grim trigger strategies ($T=\infty$) and certain punishments. In modeling a delay in punishment within the GATT system, it is not clear what tariffs should be assumed to be in place between the time that a reversionary period is triggered and the punishment starts. In a sense the "status quo" should be maintained, but it is not clear whether this could be equilibrium behavior. In the case of certain punishment the optimal deviation from a GATT tariff is to play a one-period best response $\tau_i = \tau_i(\tau_j^g)$. That is, if a deviation is desirable, the dynamic best response $\tau_i = \tau_i^D(\tau_j^g)$ is also the static best response $\tau_i(\tau_j^g)$. When this is true, as long as a punishing country does not punish outside of the GATT system, a deviating country has no incentive to alter its strategy in the period between the identification of cheating and the initiation of punishment. At this point, we assume that all punishment is within the framework of GATT. We will later remove this assumption, to determine whether adhering to GATT-DSP is Nash equilibrium behavior when countries have the option of punishing outside of the system.

Suppose punishment is delayed s^* periods and the cost structure of international obligation is (i) or (ii). Then a cooperative tariff pair (τ_1^g,τ_2^g) can be sustained in equilibrium if and only if

$$U_i(\tau_i(\tau_j^g),\tau_j^g)-c-U_i(\tau_1^g,\tau_2^g) \le \sum_{s=1}^{s^*}(U_i(\tau_1^g,\tau_2^g)-U_i(\tau_i(\tau_j^g),\tau_j^g))\,\beta^s + \sum_{s=s^*+1}^{\infty}(U_i(\tau_1^g,\tau_2^g)-U_i^N)\beta^s \qquad (17)$$

or

$$-c+\left(\frac{1-\beta^{s^*+1}}{1-\beta}\right)(U_i(\tau_i(\tau_j^g),\tau_j^g)-U_i(\tau_1^g,\tau_2^g)) \le \frac{\beta^{s^*+1}}{1-\beta}(U_i(\tau_1^g,\tau_2^g)-U_i^N) \qquad (18)$$

Clearly, an increase in s^* reduces the right-hand side of this inequality and increases the left-hand side, making cooperation more difficult. The above formulation also

easily accommodates stochastic delay until punishment, in which case $E(\beta^{s^*+1})$ replaces β^{s^*+1}. For instance, s^* could be generated by a geometric or negative binomial random variable. In the former case

$$E(\beta^{s^*}) = \sum_{t=1}^{\infty} \beta^t p(1-p)^{t-1} = \frac{\beta p}{1-\beta(1-p)} \tag{19}$$

where $\text{Prob}(s^*=t) = p(1-p)^{t-1}$, $0 < p < 1$.

When international obligation imposes a cost as in (iii), the inequality in (18) is altered, but the same qualitative result goes through. This is also true when punishment is finite and uncertain or when demons are incorporated. Generally, increasing s^* increases the value of τ_i that maximizes $V_i(\tau_i, \tau_j^g)$. However, in these cases the specification of the countries' strategies in the interim period between the identification of cheating and the onset of punishment is more complicated. Static and dynamic best responses do not coincide and there is a non-trivial decision whether to adhere to a GATT-determined policy during the period.

The issues of international obligation and delay until punishment interact in affecting the choice to pursue remedies within the GATT system or outside of the system. Due to international obligation, a decision to punish a deviating country outside of the DSP guidelines imposes a cost on the country initiating the punishment. This cost must be weighed against the losses that might occur due to delay in punishment within the system, or possibly even a finding of no violation.[14]

Again,we illustrate these considerations in the special case of certain punishment and grim trigger strategies. Suppose that s^*, which may be deterministic or random, is the period of time before punishment may be pursued

[14]Domestic laws such as U.S. Section 301 might be viewed as an attempt to lower this cost by supplanting international obligation by domestic obligation

within the DSP. If the cost to a punishing country from deviating from the DSP is a one-time cost as in (i), the country will punish outside of the DSP if

$$U_j^N - c - U_j(\tau_j^g, \tau_i(\tau_j^g)) + E\left(\sum_{s=2}^{s^*} \beta^{s-1}\,(U_j^N - U_j(\tau_j^g, \tau_i(\tau_j^g)))\right) \geq 0 \tag{20}$$

or
$$-c + \frac{1-E(\beta^{s^*})}{1-\beta}\,(U_j^N - U_j(\tau_j^g, \tau_i(\tau_j^g))) \geq 0. \tag{21}$$

For instance, when s^* is distributed according to a geometric distribution with parameter p, $E(\beta^{s^*}) = (\beta p)/[1-\beta\,(1-p)]$, and the above inequality becomes

$$-c + \frac{1}{1-\beta(1-p)}\,(U_j^N - U_j(\tau_j^g, \tau_i(\tau_j^g))) \geq 0. \tag{22}$$

The inequality in (21) can be used to assess the benefit from punishing outside of the DSP at any point in the DSP itself. Suppose a country has pursued a grievance in the DSP up to some time t and let s^* represent the number of periods beyond t that the country must wait until the DSP allows punishment. Then the inequality in (21) determines whether it is worthwhile to punish outside of the procedure at t. If the distribution of the punishment time exhibits a decreasing hazard rate then it is possible that a country might pursue a grievance within the DSP and decide to punish outside of the framework if the procedure has not specified a punishment by the time t is reached.[15] Hence, our formulation of the interaction of delay and international obligation is consistent with the pursuit of punishment within the DSP, punishment outside of the DSP, and a combination of both.

If the cost to a country punishing outside of the DSP is a per period cost as in (iii) then the decision whether to punish within or outside of the mechanism is independent of the anticipated delay until punishment. The payoff per period

[15]As mentioned earlier, domestic legislation such as U.S. 301 may serve to precommit governments to discount international obligation by requiring punishment after a certain time period. In this case, a country might pursue a grievance in the DSP but retaliate in a GATT illegal fashion even without a decreasing hazard rate.

obtained while waiting to be able to punish within the mechanism is $U_j(\tau_j^g,\tau_i(\tau_j^g))$. The payoff from punishing outside of the mechanism is U_j^N-c. Of course, once the mechanism itself specifies a punishment, it is best for a country to punish within the mechanism. This formulation of cost is then consistent with a policy of punishing outside of the DSP while pursuing a grievance within the procedure.

The above discussion of the decision to punish within or outside of the DSP must, of course, be taken into account when determining the gain to a country from cheating on the GATT tariffs. The ability to punish outside of the DSP enhances the ability to reach low cooperative tariff levels. Of course, under both specifications of the cost of violating international obligation, a DSP that reached a verdict rapidly in the event of a violation could possibly support even lower tariffs.

C. Identifying Violations

A feasible role for DSP, and one which it arguably was created to perform, is as a monitoring device that distinguishes between true deviations from a cooperative agreement and mistaken perceptions or claims that such a deviation has occurred. These claims may be due to the imperfect observability of cheating or simply to opportunistic behavior. In modeling a monitoring role for the DSP it seems important to construct an analytical framework in which, in equilibrium, the procedure may be justifiably triggered, due to deviations from an implicitly cooperative agreement, and triggered when no actual deviation occurs. This creates a nontrivial inference problem in resolving the dispute.

The extension of our basic model involving demons provides such a framework. In an implicitly cooperative agreement in the demon model, reversionary periods may be triggered following periods in which both countries adhere to the agreement or they may be triggered due to the existence of a demon. For simplicity, suppose that the implicitly cooperative tariff levels are the GATT

levels, $(\tau_1^c,\tau_2^c) = (\tau_1^g,\tau_2^g)$, there is no delay until punishment if a violation is detected, and the DSP detects violations instantaneously if a complaint is initiated. If the countries set tariffs at (τ_1,τ_2), complaints will be initiated with probability $1-F(\tau_1,\tau_2)$. If a complaint is initiated and no violation takes place ($\tau_i = \tau_i^g$, i=1,2) then no punishment occurs, and the countries continue in a normal period (setting τ_i^g). Hence, allowing instantaneous and perfect determination of a violation if a complaint is brought forward allows us to set $F(\tau_1^g,\tau_2^g) \equiv \bar{F}(\tau_1^g) = 1$ in equation (15) while maintaining $\bar{F}(\tau_1) < 1$ for other values. This raises the payoff to behaving cooperatively, while allowing a non-zero probability of a violation (due to a demon) and the resulting reversion that would occur.

Of course, the DSP is not instantaneous, nor does it perfectly separate violations from compliance. To the extent that these imperfections exist, the monitoring benefit of the procedure would be muted and perhaps even reversed when erratic decisions and international obligation prevent countries from punishing actual violators.

5. Conclusion

Previous theoretical treatments of GATT (See Ludema (1990) and Hungerford (1990)) have provided a skeptical view of the role of GATT in facilitating trade liberalization. We believe strongly that this view results directly from the ease in fitting the deficiencies of GATT and DSP into formal mathematical models and the difficulty in formally modeling GATT benefits. Since countries clearly believe that GATT is important, it is hard to concur with the conclusion of these papers that GATT restricts the ability to maintain low tariffs.

To model the benefits of GATT, we focus on the role of international obligation. Roughly, international obligation is a perceived cost that is incurred if a country deviates from an international agreement. In vague terms, it might be viewed as the political equivalent of "living with one's conscience." By including

international obligation in a repeated game model of implicitly cooperative trade agreements, we provide a parametric class of models spanning the range between the standard noncooperative supergame models of implicit collusion, where obligation is zero, and the cooperative game models of collusion, where obligation is infinite (agreements are binding).[16] While we are aware of the limitations of such brute force modeling, we think, as do legal experts who have written on the topic, that it is international obligation that makes GATT and a DSP desirable, as long as the DSP doesn't make identification and punishment of violators too difficult.

Taking the institution as given, our analysis shows that the GATT- specified tariff levels are an important determinant of the degree to which the institution facilitates international cooperation. If these tariff levels are unrealistically low relative to the implicitly cooperative levels in the absence of GATT, the institution will not aid in lowering tariffs (and, conceivably, could raise them). The DSP may hinder the ability to cooperate by delaying punishment or making it more costly. When this is true, punishment outside of GATT may work well as a second-best mechanism to facilitate cooperation. By explicitly modeling these forces, we have attempted to capture the essence of the "twin engines of international obligation and retaliation" (Hudec, 1990c, p. 14), which are emphasized in the legal literature.

Of course, institutions as complicated as the GATT and DSP are reflections of and are influenced by a vast array of factors not captured by these simple models. Foremost among these factors is the fact that GATT itself is a nexus of contracts that is incomplete in its coverage of future contingencies. This is, of course, a principal reason why the DSP may be viewed as a major component of GATT; it is the mechanism by which incomplete provisions of GATT are completed. Given this

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[16]An anonymous referee has suggested that our formulation of the cost imposed by international obligation is reminiscent of Crawford's (1982) treatment of the cost of backing down from a precommitted bargaining stance in the process of negotiation.

role, it is quite possible that the original agreement would not have been signed without the DSP.

We have also ignored other aspects of GATT that beg analysis. We have chosen tariffs as the strategic choice of countries, although our analysis could be carried out for a variety of instruments. Our analysis also focuses on bilateral, rather than multilateral, conflict and cooperation. In a multilateral treatment, a reputational justification for international obligation might be possible. This would address the current weakness of our reduced-form treatment of international obligation. This, however, appears to be a formidable task.

FIGURE 1

Value Function Arising with International Obligation

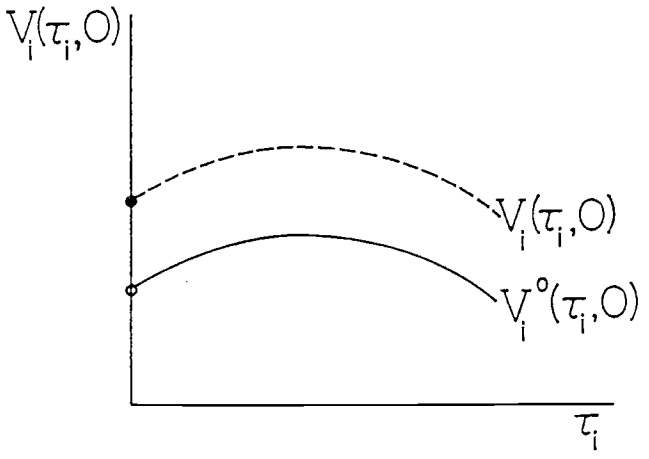

Figure 1a. Obligation enforces free trade

FIGURE 1

Value Function Arising with International Obligation

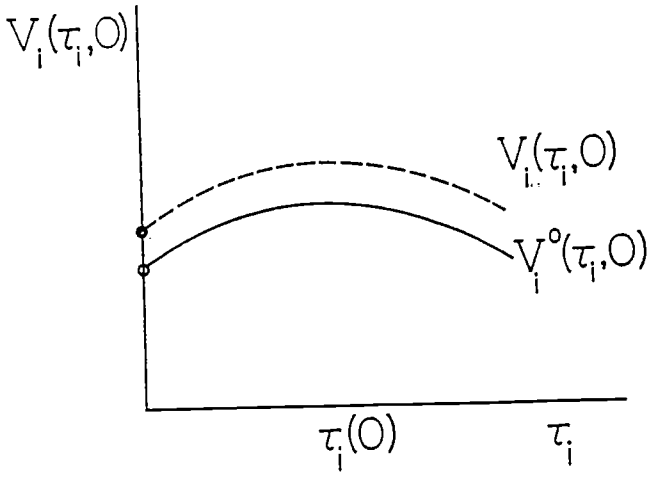

Figure 1b. Obligation does not enforce free trade

FIGURE 1

Value Function Arising with International Obligation

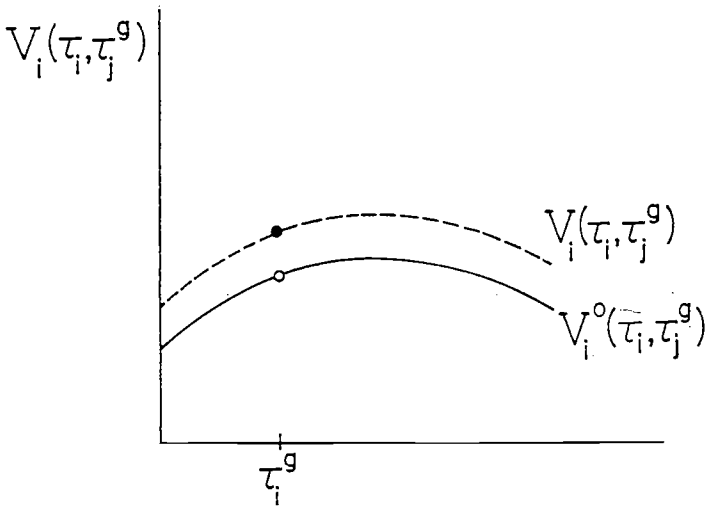

Figure 1c.

Table 1
Examples of Retaliation
U.S. 301 Cases

Original Action or Complaint	Country	GATT DSP	U.S. Retaliation	Timing
Export subsidy on wheat flour	EC	Yes	Export subsidy on wheat flour	Before panel report
Preferences on citrus imports	EC	Yes		
			Tariff on pasta	After EC block of citrus panel report
Export subsidy	EC	Yes		
Nontariff measure*	Canada	No	Symmetric nontariff barrier	Not applicable
Failure to abide by bilateral agreement	Argentina	No	Termination of agreed tariff concessions	Not applicable
Quantitative restrictions on leather	Japan	Yes	U.S. tariff and Japanese tariff concession	Agreement of U.S. & Japan after panel report
Failure to abide by semiconductor agreement	Japan	Yes	Tariff (Complaint filed by Japan on U.S. tariff retaliation)	Not applicable-no ruling
EC tariffs on imports of Spain	EC	No	Tariff	Not applicable

Inadequate patent protection	Brazil	Yes (Filed by Brazil)	Tariff	Before panel
Import ban on treated beef	EC	Yes	Tariff	Panel appointment blocked

*Canadian government denied tax deductions to Canadian businesses that advertised on U.S. border stations.
Sources: Hudec (1990b) and Hamilton and Whalley (1991)

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