Voluntary Export Restraints, Antidumping Procedure, and Domestic Politics

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A voluntary export restraint (VER) is preferred to a tariff by a government concerned about electoral returns when the influence of industry profits is large relative to the losses to consumers from higher prices. If the foreign firm is uncertain of these pressures, the antidumping (AD) code facilitates the complete transfer of the relevant information and generates a VER rather than a tariff in equilibrium. The choice across instruments is determined by the political attributes. Domestic and foreign profits rise with the AD-generated VER, and the VER lowers the volume of trade by more than the expected duty. (JEL F12, F13)

The Reagan Administration has maintained that the Japanese should decide unilaterally to cut back car exports to the United States, thus permitting the Administration to maintain its free trade policy, at least in principle.
—*New York Times,*
1 May 1981, p. A1.

The only alternative to these "mild and temporary" restraints on Japanese sales, the Reagan team contends, was a tough congressional quota, which might have become permanent.
—*New York Times,*
2 May 1981, p. 1:22.

The use of voluntary export restraints (VERs) as negotiated trade barriers by the United States and the European Community has risen dramatically since the mid-1970s.

Many of these VERs are the outcome of negotiations that originated as antidumping actions or other forms of administered protection. In this paper the use of the antidumping (AD) code generates a VER in equilibrium as the outcome of a signaling game between a foreign exporter and the local regulating authority.

The General Agreement on Tariffs and Trade (GATT), under its "unfair trade" provisions allows its signatories to punish the dumping of goods by imposing a duty.[1] The United States has enacted an antidumping law consistent with GATT principles, namely the Tariff Act of 1930 as amended by the Trade Agreements Act of 1979.[2] These GATT-consistent antidumping procedures have, however, generated outcomes that violate GATT principles. Antidumping procedures are observed to be forerunners of most "agreements" to restrain trade (Patrick A. Messerlin, 1987); Thomas J. Prusa (1992) shows that about one third of all antidumping petitions are withdrawn, and typically "only after the domestic industry has achieved some type of out-of-court settlement with its foreign rival" that usually takes the form of a price or quan-

[1] Article VI and the antidumping code was adopted during the Tokyo Round (GATT, 1979). The code also allows for the imposition of countervailing duties to protect against subsidized foreign competition.
[2] The European Community (EC) has similar procedures to investigate and adjudicate on dumping complaints.

tity restriction. The effects of the administrative procedures on patterns of protection and international trade flows therefore deserve scrutiny.[3]

The antidumping administrative procedure allows the regulatory authorities to make a preliminary determination and to impose a preliminary remedy (usually a tariff) in favor of the affected industry while an investigation is underway. This preliminary tariff acts as a signal of the willingness of the agency to impose the optimal duty at the end of the investigation if a voluntary undertaking to cease the dumping activity is not forthcoming. The relative costs to the agency of imposing these tariffs depend on the electoral returns from protecting the affected industry (and hence the strength of the industry pressure group) relative to the electoral returns from maintaining a liberalized trade policy. If the administration is only partly vulnerable to the protectionist pressure, the likely outcome is the immediate imposition of the optimal tariff. If protectionist pressure is large however, a preliminary tariff is imposed which, as a threat, is sufficient to induce a mutually acceptable compromise. Such a compromise is a voluntary undertaking by the foreign exporter to reduce or curtail its activities in the local market.

Provisional duties precede VERs to a large degree (Messerlin, 1987). According to J. M. Finger et al. (1982) who analyzed the U.S. antidumping administration, "large cases, the facts show, almost always begin as administered protection and end up as negotiated 'voluntary' export restraints." An explanation offered by Finger et al. with reference to presidential decisions on "high-track" (political, discretionary) cases is that the president clearly prefers the electoral gains without the welfare losses. The president prefers not to have to make a decision for or against protection but to gain protection in the form of a VER without the expensive electoral and political loss associated with a tariff. In this model, in some cases the trade regulating agency will be required to make a decision for protection; the foreign exporter may step in beforehand and offer a VER.

Dumping has traditionally been analyzed in terms of international price discrimination (Jacob Viner, 1923; James A. Brander and Paul Krugman, 1983), below cost sales (Wilfred J. Ethier, 1982), to allow learning by doing (Howard K. Gruenspecht, 1988) or the optimal response to unused capacity in the face of stochastic demand (Robert W. Staiger and Frank A. Wolak, 1992). The effect of the antidumping code has surfaced recently as a topic for investigation. Prusa (1992) makes two observations: withdrawn or suspended AD petitions are associated with voluntary undertakings to restrain trade, and that these cases restrict trade by at least as much as cases which resulted in duties. The conditions under which these phenomena occur are the focus of interest in this paper and a possible explanation is provided here.

Staiger and Wolak (1992, 1994) consider the effect of agreements when a foreign monopoly has incentives to dump, and they establish empirically that AD petitions, whether finalized in the application of AD duties, or suspended with agreements, restrict imports and expand output of import-competing industries. Unfortunately they leave the connection between the AD procedure and the negotiations over agreements to restrain trade unexamined. In this paper, a model of the AD procedure motivated by political concerns generates agreements to restrain trade (in the form of VERs) and the effect on domestic prices and output conforms to the observations made in these previous studies.

In a separate literature, a number of authors have pondered the increased use of VERs and have pointed to political influences.[4] Baldwin (1989) surveys the political economy and trade literature on the emergence and magnitude of the VERs, and divides the analysis into two approaches, the self-interest versus the social concern approach. The individual votes for or against a tariff or a subsidy if the policy

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[3] See Richard Boltuck and Robert E. Litan (1991) for a collection of papers by authors who have considered whether the administrative procedures can be improved to limit the occurrence of these GATT-inconsistent outcomes.

[4] See Robert C. Feenstra and Tracy R. Lewis (1991), Robert E. Baldwin (1989), Arye L. Hillman and Heinrich W. Ursprung (1988) and Jagdish Bhagwati (1988).

increases or decreases the individual real income (Wolfgang Mayer and Raymond Riezman, 1990, for example) and in the social choice approach, the government applies protection to protect and promote national and political goals such as the redistribution of income (such as Staiger and Guido Tabellini, 1987) or raising campaign contributions that are useful for reelection (Gene M. Grossman and Elhanan Helpman, 1994). In the context of a government agency with an objective function that must balance both private and social considerations, I investigate the consequences of Baldwin's (1985) observation that the deliberations by the regulatory agencies and the results of the investigations are not made known to the major participants and general public. "As a consequence of this procedure...unjustifiable political factors rather than sound economic reasoning determine the outcome of the case" (Baldwin, 1985 p. 195).

Trade policy then is contingent on political factors, as these enter into the economic decision of the regulatory agency, justifiably or not. Feenstra and Lewis (1991) recognize this political pressure to restrict imports. In a cooperative framework with a similar information structure, they generate incentive-compatible conditions under which the home country has no incentive to overstate the pressure for protection. The model developed in this paper improves on their work along the following dimensions. Firstly, bargaining is noncooperative, the resulting equilibrium robust to different bargaining environments. No ex ante commitment to a mechanism is necessary. Secondly, the quota rents transfered and hence the division of the surplus are endogenously determined here, unlike those in Feenstra and Lewis which are a parameter of the solution. Thirdly, in equilibrium, information is transmitted: the political pressure for protection is observed and is acted upon by the foreign country.

This paper establishes the following results. Firstly, VERs are preferred to tariffs by governments who experience high electoral returns to firm profits relative to the losses accruing to consumers due to higher prices. Secondly and most importantly, the AD procedure provides a simple mechanism for local governments who prefer VERs to tariffs to

communicate their willingness to accept such an accommodation, should one be offered. Thirdly, profits for firms at home and abroad rise with the VER, and the volume of trade shrinks with the VER by more than with a tariff alone—the government actively engages in establishing a collusive agreement at the expense of domestic consumers in some instances.

Section I of this paper shows the increasing prevalence of foreign firm "undertakings" subsequent to a provisional determination as the dominant outcome in the antidumping procedure in both the United States and the European Community. The details of the procedure for investigating and finding the dumping allegation and the provisions for imposing a duty are discussed. This process is modeled by developing a political theory of tariff and VER determination and the choice between them is then considered. The next section models the AD procedure as a signaling game which has, as an equilibrium, an outcome similar to those described in the Section I. Where proofs are omitted in the text, they can be found in the Appendix.

I. Dumping and VERs

A. *The Rise of Nontariff Barriers*

In the period of the 7 rounds of negotiation spanning 33 years, the GATT has restricted the use of tariffs to 4.9 percent of their original levels in the United States, 6.0 percent in the European Community and 5.4 percent in Japan (Bhagwati, 1988).

Since the mid-1970's, however, we have witnessed the growth of nontariff barriers (NTBs), investigated, imposed and administered by legislatively authorized agencies exercising executive and quasi-judicial powers for the protection of local industry. There has been a significant increase in the comprehensive index of nontariff barrier coverage for all the major Organization for Economic Cooperation and Development country groups except for Japan, which started in 1986 from a higher initial level than the European Community or the United States (Bhagwati, 1988). A large proportion of these nontariff barriers are the outcomes of administrative action. Be-

tween 1975 and 1979 alone (the period in which the Trade Act of 1974 was in effect) 245 cases under the AD law were filed, of which 208 were decided, 35 percent in favor of the petitioners (Finger et al., 1982). For the EC between 1970 and 1985, 129 antidumping cases against 44 countries were brought before the regulating agencies, predominantly in the steel and chemical industries. Of these 45 were settled by undertakings and VERs (Messerlin, 1987).

The stylized facts that require an explanation are these: there has been a rise in the use of NTBs and in particular VERs as the use of tariffs has declined; that many of these VERs are preceded by administrative action, such as the antidumping code; and that political considerations "intrude" on trade policy.

B. Antidumping Administration

If foreign merchandise is sold in the United States at "less than fair value" the affected industry may file a petition with the International Trade Administration (ITA) of the Department of Commerce. The ITA investigates if dumping has occurred, that is if the price charged in the United States is less than the price of similar merchandise sold in the exporter's home market,[5] and if so to estimate the margin of such dumping, the amount by which the U.S. price is below "fair value." The International Trade Commission (ITC) is also required to undertake an investigation as to whether the local industry is experiencing, or is threatened with material injury.

The investigation ends when both the ITC and ITA make a positive final determination (no later than 420 days after the petition was initiated). The evidence and findings are submitted to the President for approval, and then a restraining antidumping duty may be enforced. However, if it is believed that the investigation may continue for some time, a preliminary determination based on "the best available information" is usually rendered within 45 days by the ITC and within 160 days by the ITA. If both the ITC and the ITA make a preliminary determination in favor of the petitioners, a preliminary remedy is enforced; imports will be subject to a duty determined according to the estimated dumping margin, and may be later revised (although later revisions are rare). This opportunity for preliminary action was provided to prevent irreparable injury to the domestic industry while the investigation is in progress. The investigation is terminated upon a negative determination at either stage of the process, or is suspended after an undertaking from the exporters that the shipments will be terminated, or prices will be adjusted to eliminate the effects of the imports.[6]

On occasion, the President may decide that even faster action is required. The President may authorize the U.S. Trade Representative to proceed with the imposition of a temporary tariff under the authority of section 301 of the 1974 Trade Act pending the outcome of the investigatory process under the antidumping statutes.[7] The effect is similar: temporary relief is granted while the investigation progresses, and a bargaining outcome is likely where the foreign exporter undertakes to restrain the export of the offending good.[8]

II. Preliminaries

There are two identical countries, each with its own firm producing an identical good for

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[5] Computation is made net of adjustments for differences in quality, circumstances of sale, level of trade, physical characteristics, packing and transportation costs (Tracy Murray, 1991). If no similar product is sold in the exporter's home market, the estimation is made relative to the price in other foreign markets if they exist, or relative to the costs of production.

[6] See Staiger and Wolak (1994) for a detailed view of the AD proceedings.

[7] See Bhagwati and Hugh T. Patrick (1990) for a review of the deleterious effects of section 301 on the world trading system and its inconsistency with the GATT.

[8] An interesting example is that of the duty imposed on Canadian lumber by the United States (New York Times, 1991). In 1986, Canada levied an export tax on softwood lumber (a voluntary barrier) to forestall a threat by the United States to impose a 15 percent import duty as a countervailing duty to what was believed to be Canadian subsidization. The Canadian government was alleged to be charging below-cost fees for logging on public lands. Canada announced in September 1991 that it would no longer collect the tax, and the United States began proceedings to institute a countervailing tariff.

sale in the home market only. This follows Brander and Barbara J. Spencer (1984).

Demand: $U = u(X) + m$, where X is the consumption of the good in question, and m is consumption of a competitively produced numeraire good in the world market with price 1. The subutility function $u(\cdot)$ is differentiable, increasing and concave. Then $p = u'(X)$ where p is price.

Profits: Variables without asterisks are associated with the domestic country; output of the foreign firm is x, of the domestic firm y. Total domestic consumption is $X = x + y$. Profits of the domestic firm are

$$(1) \qquad \pi = yp(X) - cy - F$$

where F are fixed costs, and of the foreign firm:

$$(2) \qquad \pi^* = xp(X) - cx - tx - F^*$$

where t is the tariff paid by the foreign firm, and F^* are fixed costs. There are no transportation costs, and marginal costs c are constant and equal.[9]

Welfare: We assume governments maximize social welfare, composed of the consumer surplus, the profits of the firm and the tariff revenue. The firm profit term is weighted by a factor s that indicates the lobbying pressure that firms can bring to bear (relative to the lobbying pressure of consumers), and simultaneously may represent the median stock/labor endowment of the consumers:

$$(3) \qquad G^s(t) = u(X) - pX + s\pi + tx$$

where $s \geq 0$ weights the profits of the firm relative to the welfare of consumers and the tariff revenue. The variable s measures the government's weighting of a dollar of firm profit to its weighting of consumer welfare (the sum of the consumer surplus and the tariff

revenue) in its reelection calculus.[10] Baldwin (1987) establishes that the politically realistic objective function[11] in (3) can be derived from a standard lobbying pressure group model, while Feenstra and Lewis (1991) do the same based on the median voter model of Mayer (1984) in a competitive, constant returns economy. Here, unfortunately we have some increasing returns. Nevertheless, it is shown elsewhere that a similar function can be derived from a median voter model, where the voters differ according to their ownership of stock in the domestic firm.[12] Under majority voting, the government's objectives reflect that of the median voter. If the sum of the consumer surplus and the tariff revenue relative to the income from ownership of stock in the import competing firm is s for the median voter, then that is exactly how the government will weight the terms in its objective function.

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[9] The results are not altered by insisting on different marginal costs across the firms, and merely complicates the arithmetic unnecessarily.

[10] Richard Baldwin (1987) and Feenstra and Lewis (1991) give extra weight to the profits of the local firms in government's objective function to factor in the lobbying pressure firms apply. In this context, they are assuming that $s > 1$. While they assume that consumers do not lobby effectively due to the diffuse nature of their losses, here consumers can in fact lobby; all that is relevant is their relative lobbying strength captured in s. It is assumed here that consumer surplus and tariff revenue have the same weight—perhaps the tariff revenue is distributed back to consumers as a lump sum.

[11] The phrase is Baldwin's (1987).

[12] Embed the import competing firm in a general equilibrium setting and apply a median voter model: government's objective becomes that of the median voter. All individuals are endowed with labor l (total labor supply is 1) and stock S_i in the import competing firm. Individuals have identical utility functions $U = u(X) + m^c$ where m^c denotes the consumption of the numeraire good (its price is one and its marginal product of labor is constant at one, so the wage is one). Individuals earn income from wages l, from stock ownership $S_i\pi$ and from their share of tariff revenue determined by their share of labor endowment ltx. Normalizing by dividing through by l, we have that income is $1 + s_i\pi + tx$, where s_i is individual i's stock/labor endowment ratio. Consumption of the numeraire good m^c must equal total income minus expenditure on good X: $m^c = 1 + s_i\pi + tx - p(X)X$. Then $U = u(X) - p(X)X + tx + s_i\pi + 1$. Since government policy is to be decided by majority rule, the government's effective objective function is that of the median voter (there are no costs to voting and this utility function possess the necessary "single-peakedness" to apply Duncan Black's [1958] theorem) whose stock/labor ratio is s. Hence the government's objective function can be written as in (3). See Rosendorff (1995) for more details.

If the distribution of stock is highly skewed in the economy, then income from profits makes up a small part of most individuals' income. The median voter will care more about the consumer welfare elements than firm profit in her utility function and so the median voter will have a very low s. If, on the other hand, ownership of stock is widely dispersed across individuals, s is likely to be large, and government will put greater weight on the profits of firms in its policy calculus. We will call (3) the electoral return function.

Government arbitrates among competing interests here, and the degree to which Stigler-type capture (George Stigler, 1971) is possible depends on the (political/electoral) strength of these competing groups. Jean-Jacques Laffont and Jean Tirole (1993) consider government to be a benevolent maximizer of a social welfare function, but acknowledge that this is an oversimplification, as its members are "subject to interest group influence" (p. 479). It is exactly this influence by competing groups that causes government to weight their welfare according to their electoral importance.

No divisions in government are presumed— the possibility of an informed "agency" acting on behalf of an uninformed "principal" is avoided here. Government in this model is aware of the market conditions and the actions of the regulators, and is in complete control of the bureaucracy. This keeps the focus on the AD code and avoids what has been called the congressional/executive branch dominance debate (Barry R. Weingast and Mark J. Moran, 1983; Mathew D. McCubbins and Thomas Schwartz, 1984).[13]

The foreign government has no domestic politics and does not apply a tariff,[14] and so it seeks to maximize the foreign firm's profits: $G^* = \pi^*$.

III. The Tariff Game

The structure of this game is similar to that of Brander and Spencer (1984) with the addition of the politically determined government objective function. The firms will Cournot compete, taking the tariff level as given. The government will choose a tariff that maximizes electoral returns. An equilibrium to the tariff game is a triple $(\hat{t}, \hat{x}, \hat{y})$, and given $\hat{t}$, $\hat{x}$ and $\hat{y}$ are given by the intersection of the best response functions to the Cournot competition: $\pi_y = 0$ and $\pi_x^* = 0$ yield best response functions

$$(4) \quad y = y(x, t), \quad \text{and} \quad x = x(y, t).$$

It will be useful to state the domestic firm's best response function: $\pi_y = p - c + yp' = 0 \Rightarrow$

$$(5) \qquad y = -\frac{p - c}{p'}.$$

Government chooses a tariff level that maximizes its electoral return function given this behavior of the firms.

PROPOSITION 1: *The optimal tariff given the best response functions of the firms is*

$$(6) \quad \hat{t} = \frac{x(1 - p_t) + sy_t(p - c) + yp_t(s - 1)}{-x_t}.$$

PROOF:
Setting $G_t^s = 0$, we get

$$(7) \quad G_t^s = -Xp_t + s(y_t p + yp_t - cy_t)$$

$$+ x + tx_t = 0$$

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[13] Government here could also be viewed as a perfectly rational, perfectly informed decision maker facing conflicting goals—it tries to give consumers low prices and firms high profits simultaneously. It could also be viewed as having a single goal—reelection. The categorization merges Graham Allison's (1969) models I and III: I suggests that the nation is treated as a single actor pursuing a set of goals rationally; III argues that "politics" and the bargaining between groups in government determines outcomes. For a critique of Allison's contruction, see Jonathan Bendor and Thomas H. Hammond (1992). For a complete analysis of the informational effects of informed agencies, see Laffont and Tirole (1993).

[14] Domestic politics is easily added to the foreign country with no gain in insight. If the firms produce for both markets, there will be intra-industry trade and electorally optimal tariffs in both countries.

where subscripts denote derivatives. Solving for the optimal tariff $\hat{t}$ yields (6).

Stability conditions[15] for the Cournot competition between the firms imply that $x_t < 0$, $y_t > 0$ and $X_t = x_t + y_t < 0$ (a tariff reduces domestic consumption relative to free trade). As the tariff rises, the foreign firm's reaction function shifts inwards raising local production and shrinking the level of exports by the foreign firm to the local market. Moreover, as the foreign firm withdraws from the market, only some of the slack is taken up by the local firm. The local firm produces more, but does not raise production by as much as the imports have fallen. Hence local consumption falls with a rise in the tariff, local prices rise, and local profits increase.

A sufficient condition for a positive optimal tariff is $p_t < 1$ and $s \geq 1$. Notice that once $\hat{t}$ and $\hat{x}$ are determined, $\hat{y} = y(\hat{x}, \hat{t})$ is implied and $\hat{x}$ and $\hat{t}$ are parametrized by s. Hence we can write the equilibrium to the tariff game for a given s merely as the pair $(\hat{x}, \hat{t})$.

COROLLARY 1: $\hat{t}$ is increasing in s, while $\hat{x}$ is decreasing in s.

The equilibrium tariff rises and level of imports falls with the strenh of the pro-industry lobby.

IV. The VER Game

Let the outcome of the noncooperative tariff game be the status quo, and suppose the foreign firm makes the following offer to the local government: "lower your tariff (let t fall); in return, we will lower our exports x." The deal will be offered and accepted if s is large enough (in a manner to be made precise below). No such deal will be offered if s is not large enough.

Why will the deal be offered by the foreign firm? If exports fall, say, by 1 unit, but the tariff falls sufficiently, then the tax paid on all exported units falls. If the tax saving exceeds the loss of revenue from the single unit now not sold then the foreign firm's profit rises above the level obtained in the tariff game.

Why will the deal be accepted by the domestic government if s is large enough? If t and x fall, tariff revenue shrinks. But as x falls, π rises (since the domestic firm continues to act like a Cournot competitor and the foreign firm has withdrawn somewhat from the market), meaning larger profits for the domestic firm. If \$1 fall in tariff revenue generates \$$\Delta$ increase in domestic firm profits, then the domestic government will accept such a deal, since it weights firm profits at a higher value than it does tariff revenue (when s is large enough). That is $s\Delta > 1$ for s large enough.

Take the Cournot equilibrium with a positive tariff $(\hat{t}, \hat{x}, \hat{y})$, which is a function of s, to the tariff game as given. The local government agrees to lower the tariff if, in return, the foreign firm restrains its exports to the local market. Both the firm and the government will accept any agreement (call it $(\bar{x}, \bar{t})$) that assures each of at least as much utility as each can gain in the tariff game (that is $\pi^*(\bar{x}, \bar{t}) \geq \pi^*(\hat{x}, \hat{t})$, the profits available in the tariff game and $G^s(\bar{x}, \bar{t}) \geq G^s(\hat{x}, \hat{t})$). This is what makes a VER "voluntary"; the tariff game serves the function of the "status quo" and these conditions are a requirement of individual rationality on the part of the players.[16] If we allow the foreign firm to make the offer, its problem is to

(8) $\max_{(x,t) \geq 0} \pi^*(t, x)$ subject to
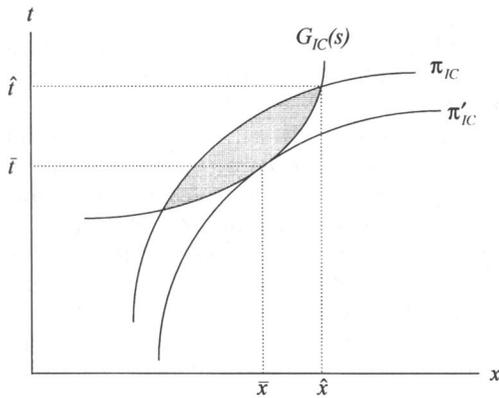
$$G^s(x, t) \geq G^s(\hat{x}, \hat{t}).$$

FIGURE 1. THE VER GAME: THE FOREIGN FIRM'S
PROBLEM

Now the government and the foreign firm agree on a pair (x, t). The local firm then acts as a Stackelberg follower to this agreement, responding to it along its best response curve. Notice that the local firm's choice of output depends entirely then on the choice of x; and once x is determined, so is y. That is $y = y(x)$—the best response function for the local firm is independent of the tariff. Hence we can restate (8) as

$$\max_{(x,t) \geq 0} x(p(x + y(x)) - c - t) - F^*$$

subject to $u(x + y(x)) - p(x + y(x))(x + y(x)) + s(y(x)p(x + y(x)) - cy(x) - F) + tx \geq u(\hat{x} + \hat{y}) - p(\hat{x} + \hat{y})(\hat{x} + \hat{y}) + s(\hat{y}p(\hat{x} + \hat{y}) - c\hat{y} - F) \hat{t}\hat{x}$.

Graphically, we can plot the both players' indifference curves in (x, t) space. Domestically, higher tariffs mean, usually, more revenue, higher profits but higher prices. The government, in order to remain indifferent, will tolerate greater imports (and lower firm profits) as long as it is recompensed with higher tariff revenues to distribute to consumers who experience higher prices. That is the indifference curves will be positively sloped if higher imports are associated with higher tariffs (as long as the price effect does not dominate—that is, consumers do not weigh heavily in the government's objective function or s is large). Similarly, the indifference

curves (isoprofit curves, actually) for the foreign firm are usually positively sloped: higher tariffs must be associated with increased exports in order that profits remain constant.

PROPOSITION 2: *A sufficient condition for both players' indifference curves to be positively sloped is $s > 2 + y_x$ and $t < p'[(1 + y_x)x - y]$, that is, for large s and small t.*

While simpler sufficient conditions exist, the condition $s > 2 + y_x$ has particular importance for the next section. In addition, the indifference curves are required to be strictly convex to assure uniqueness of the solution to (8). That is the slope of the government's indifference curve increases as imports increase (the indifference curve is convex with respect to the origin) — as successive units of the good are imported, the marginal losses to the domestic firm rise, and in order to maintain the electoral returns to government constant, larger and larger amounts of tariff revenue are necessary. As for the foreign firm, as tariffs rise, greater and greater exports are necessary to keep profits constant.

As can be seen in Figure 1, the shaded region is the set of Pareto superior agreements to the optimal tariff, and the solution to (8) occurs at the tangency of the two players' indifference curves. Call the solution to this problem $(\bar{x}, \bar{t})$, $\bar{y} = y(\bar{x})$ and it is parametrized by s.

V. Which Restraint Does Government Prefer?

The government has both tools at its disposal. Given s, the government may adopt the optimal tariff and generate electoral return $G^s(\hat{x}, \hat{t})$, or it may adopt the optimal VER/tariff combination (once offered by the foreign firm) and yield $G^s(\bar{x}, \bar{t})$. The choice across instruments is determined by the obvious welfare comparison, and is parametrized by the political parameter s.

DEFINITION 1: *A VER is a solution to (8) such that $\bar{x} < \hat{x}$.*

PROPOSITION 3: *There exists some $s^* \in \mathbb{R}$ such that for all $s \geq s^*$ a VER is offered to and accepted by all governments of type s.*

As long as s is large enough, there is some surplus available to both the government and the foreign firm; welfare Pareto improvements are available in excess of that achieved in the tariff game. If s is large enough, the indifference curves are upward sloping, as in Figure 1 and the shaded area indicates the set of Pareto gains. A solution to (8) is an agreement to share these gains. Proposition 3 states that this surplus exists (and a VER generates mutual gains) only if s is large enough.

In equilibrium the local government accepts a reduction in x, a VER (and a reduction in t, a tariff reduction), as long as the weight on the profits of the firm in the government's electoral return function is large enough. If the foreign firm is rewarded for a smaller export volume with a lower tariff on those items it does export, the gain in revenue from the lower tax bill will exceed the loss associated with a smaller market share. The local government may gain: as imports fall, local profits rise (due to increased prices associated with the cutback in foreign exports). If the weight on the rise in profits is large enough, the electoral returns to the rise in profits exceed the losses due to lower tariff revenue; at the very least these must equal. The local government is at least no worse off.

It is crucial that domestic firm profits rise with the VER relative to the optimal tariff. As exports fall from their optimal tariff levels, local output rises while domestic consumption falls (raising the domestic price). So domestic price and output rises confirming the rise in domestic profits. Local consumers of course bear the burden.

PROPOSITION 4: *Domestic consumption falls as the VER replaces the tariff, while local production, prices and profits rise. That is $dX/dx > 0$ while $dy/dx < 0$, $dp/dx < 0$ and $d\pi/dx < 0$.*

Consumers' losses are additive: not only are they consuming less under the VER than they were under the tariff, but the redistributed tariff revenue has shrunk. Local firms then are taking up some of the slack induced by the withdrawal of the foreign firm from the local market, but not all of it. The local firms are expanding output as the foreign firm contracts,

but the expansion is smaller than the contraction. Hence the total production is lower than before, resulting in higher prices and higher profits.

Foreign firm profits are constrained to be no lower than those available under the optimal tariff. The VER then has successfully facilitated collusion between the domestic and foreign firms—levels of output under the VER are lower abroad and higher at home than would have been the case without the VER.[17] If the VER is credible, then so is the commitment to higher prices by both firms and successful collusion is achieved: the profits of both domestic and foreign firms rise. For example, the 1981 VER on Japanese automobile exporters increased the profits of car manufacturers in both the United States and Japan (John C. Ries, 1993; Feenstra, 1984).[18]

Note too that the presence of a VER means a reduction in the volume of trade over and above the restriction induced by the optimal tariff. We should expect to lower export volumes in those instances where VERs are adopted relative to that which we would expect if the optimal tariff is imposed—VERs exert a greater restraint on trade than do duties.

Two assumptions have been made in describing this agreement to voluntarily restrain trade. Firstly, the local government is able to

[17] Kala Krishna (1989) establishes that a VER acts to commit the foreign firm to a lower export level allowing the domestic firm to cut back output and exploit the movement towards the monopoly level of output and profit (hence a reduction in local output). There are a number of differences with respect to Krishna's facilitating practices. Firstly, this is a Cournot game in a single market where firms produce an identical good; Krishna has a Bertrand environment in two markets where firms produce different goods. In the Krishna paper, if the goods in the two markets are substitutes then an imposition of a VER close to the free trade equilibrium raises both firms' prices and profits, and shrinks output. Here a VER close to the tariff equilibrium associated with a small decrease in the tariff itself yields profits at least as high as the tariff equilibrium profits for both firms. Foreign output falls and local output rises.

[18] Collusion between a domestic and foreign firm, negotiated by the domestic government is not a violation of antitrust regulation and is permitted under the Noerr-Pennington doctrine (which exempts U.S. firms from prosecution under antitrust law when undertakings are negotiated by a government agency). See Prusa (1992) for a detailed analysis of this doctrine.

credibly and simply communicate the value of s to the foreign firm, and secondly that the bargain described is achieved without any institutional or bargaining structure. The foreign firm, in order to respond optimally to this provided information must be able to grasp the details of a complex political and electoral process that for the most part takes place behind closed doors, or at least far from public scrutiny. That elected officials seek to minimize the public disclosure of their sources of campaign financing would suggest that the knowledge of the political influences they are subject to is not widely known.

Secondly, in order for the deal to be struck, a bargaining structure that generates these outcomes is required. Undoubtedly, a number of structures are feasible and would yield this outcome. The purpose here however is to establish that the AD procedure provides just such a structure, and although GATT consistent, yields the unintended consequences of nontariff barriers.

The AD process allows a sufficient statistic for the value of s to be publicly stated: the preliminary tariff imposed while the investigation continues. The local government is able to signal its willingness to switch to a VER by picking an appropriate tariff which provides all the necessary information to the foreign firm about the political pressure the local government faces.[19] The procedure then is an institution that provides for an efficient transfer of information that otherwise would not necessarily occur.

VI. The Antidumping Procedure

The sequence of moves of this game mirrors that of the administrative procedure. The game has three players: the local government of type s, G^s and the foreign firm F and the domestic firm D (see Figure 2).

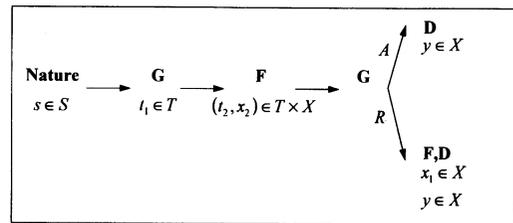The domestic industry is presumed to have filed an appeal with the authorities for some

FIGURE 2. THE SEQUENCE OF MOVES IN THE ANTIDUMPING GAME

relief under the dumping statutes.[20] Immediately, the fire alarm is pulled and G^s moves first.[21] An action for the government is to choose a tariff level $t_1 \in T \subset \mathbb{R}_+$ it threatens to impose on the foreign firm F (this corresponds to the preliminary determination of a margin of dumping). The foreign firm makes an offer of a tariff/export combination $(t_2, x_2) \in T \times X \subset \mathbb{R}^2_+$ (this corresponds to the opportunity provided to the foreign firm to offer an undertaking to cease the dumping). The government may accept the offer (play A), or reject it (play R), in which case the preliminary determination becomes final. If the government accepts the offer, the domestic firm then gets to choose its level of output ($y \in X$) and the game ends. If G^s rejects the offer, the government is obliged to finalize its preliminary tariff level $t_1 \in T$, leaving both firms to respond to the imposed tariff $(x_1, y) \in X^2$. Note that the final stage of the game (played

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[19] Alternatively, the local government may prefer not to disclose all the sources of influence it is subject to. Instead, the net effect is all that is relevant, and the choice of a preliminary tariff rate is sufficient to provide the necessary information.

[20] The legal definition of dumping requires that the foreign firm sets prices at "less than fair value," and that the local industry experiences or is threatened with "material injury." Here, the margin of dumping may or may not actually be positive. We will assume therefore that sufficient evidence is available to make it worthwhile for the firm to initiate antidumping proceedings. For example, the foreign monopolist may produce for the foreign market too—and successfully price discriminates across markets. There is however clear evidence of material injury due to imports, and therefore the dumping activity is "actionable." In particular, domestic profits are decreasing in imports and thus fall with imports unless duties are forthcoming.

[21] A number of recent papers have explored the effects on current output of an anticipated VER or AD action (Makoto Yano, 1989; James A. Anderson, 1992). These games have an earlier pre-AD action decision move for both players. This possibility is not considered here.

once the government has rejected the offer) is the same as the pure tariff game examined earlier.[22]

Note that the type of government the foreign firm is facing is private information to the government. The informational asymmetry captures the essence of the political appointment process to the bureaucratic agency. As the committee members are appointed it is reasonable that both they and any onlooker are unsure of the political pressures that will come to bear. But only after holding the office for a period does it become apparent to the agency members what these pressures truly are; what is more, the nature of these pressures are likely to change from case to case, and it is only in the process of investigation and administration of the procedures do these political vulnerabilities become apparent to the agency.

The foreign exporter however remains uninformed as to the political sympathies of the local government. This is not to say that they have no idea of the nature of the political consequences but they are merely asymmetrically informed.[23] Then s is private to G^s but is commonly known to be drawn from the strictly positive density function ϕ with distribution Φ with finite support S. The first stage of the game resembles the standard signaling game. Initially, G^s selects a message t_1 from T after which F selects an action $(t_2, x_2) \in T \times X$, which is then accepted $(a = A)$ or rejected $(a = R)$. The domestic firm chooses output once the government has accepted or rejected:

$\mathbf{y}(y \mid t_1, t_2, x_2, a) \in X$. Posterior beliefs are defined as $\mu = \mu(s \mid t_1)$. A strategy for the government is $\mathbf{g}: S \to \Delta(T \times \{A, R\})$, for the foreign firm: $\mathbf{x}: T \to \Delta(T \times X \times X)$ and for $\mathbf{y}: T \times T \times X \times \{A, R\} \to \Delta(X)$ where for a finite set $\mathcal{D}$, $\Delta(\mathcal{D})$ denotes the set of probability distributions over $\mathcal{D}$.

Payoffs for each player are as before: the local government values the consumer surplus, firm profits and tariff revenue weighted by s: $G^s(t, x, y) = u(x + y) - p(x + y)(x + y) + s\pi(x, y) + tx$ while the foreign firm and domestic firm value profits. For the domestic firm $\pi(x, y) = yp(x + y) - cy - F$, and for the foreign firm $\pi^*(t, x, y) = xp(x + y) - cx - tx - F^*$.

Equilibrium

The equilibrium concept we adopt is that of a perfect Bayesian equilibrium (PBE) due to Drew Fudenberg and Tirole (1991), the obvious extension of subgame perfection to incomplete information environments. Each type of government chooses its actions optimally given the actions and beliefs of the foreign firm, the firm forms its beliefs in a Bayesian manner, and optimizes given those beliefs. No restriction on beliefs is made at out-of-equilibrium information sets, and all actions by the firms are optimal on the receipt of all signals (not just equilibrium signals). The domestic firm chooses its output optimally given the strategies of the other players.

There is a single, intuitive, separating equilibrium to this game. Each type of government must at the first stage of the game choose a preliminary tariff level t_1 that accomplishes two tasks: it must send a signal to the foreign firm of its willingness to accommodate a lower level of exports in return for a tariff reduction, and in case no acceptable offer is forthcoming, it must be a tariff that is optimal in the pure tariff game. It is apparent that the optimal tariff $\hat{t}$ plays such a role (where $\hat{t}$ is as defined in Proposition 1). It is monotonic in s by Corollary 1 and therefore the foreign firm on observing $\hat{t}$ can immediately infer the government's type, and offer a VER if one will be accepted, and if not, $\hat{t}$ is the optimal solution to the pure tariff game.

The effect is that if a $\hat{t}$ is observed that is large enough (that is, sent by an s large

enough), then such a government is signaling its willingness to accept a VER and share the available surplus, while lower types signal that they plan to implement the optimal tariff. The foreign firm can do no worse than obtain the profit available under the optimal tariff regime, and may do better with a VER; the same is true for the domestic government. The firm and government agree to share the surplus by agreeing to a VER.

Consider the last steps of the game. The domestic firm always responds to the actions of the other firm in an optimal manner, that is along its best response curve (4). If the government has accepted an offer of a VER (and tariff reduction), the domestic firm now responds optimally to the reduced foreign exports to its home market; if G^s has rejected the VER, the domestic firm Cournot-competes with the foreign firm each taking the preliminary tariff level t_1 as given, as in the simple tariff game above. In the preceding move, F makes an offer of a VER/tariff combination that yields it at least as much return as in the pure optimal tariff game (and which they believe will be accepted). This offer will take the form of $(\bar{t}, \bar{x})$, the solution to the VER game above. The offer is accepted by all types of government that are large enough, as in Proposition 3.

PROPOSITION 5: $(\mathbf{g}, \mathbf{x}, \mathbf{y})$ *and* μ *is an equilibrium to the signaling game, where*

$$\mathbf{g} = \begin{cases} (\hat{t}(s), A) & if\, G^s(t_2, x_2) \geq G^s(\hat{t}, \hat{x}) \\ (\hat{t}(s), R) & otherwise \end{cases},$$

$$\mathbf{x} = (\bar{t}(s), \bar{x}(s), x(y, t_1)), \quad and$$

$$\mathbf{y} = y(x, t_1)$$

where $x(y, t_1)$, $y(x, t_1)$ *are as in (4). Beliefs are*

$$\mu(s \mid t_1) = \begin{cases} 1 & if\, s = \hat{t}^{-1}(t_1) \\ 0 & otherwise. \end{cases}$$

Intuitively, when the government of type s rejects any offer, the noncooperative tariff game is played. By Proposition 1, $\hat{t}$ is optimal

for each type. If G^s accepts an offer, the offer that it elicits must be optimal for its type. This is ensured by eliciting $(\bar{t}(s), \bar{x}(s))$ which we know from Proposition 3 is at least as good as rejecting and playing the tariff game. Hence each type of government has no incentive to deviate. The foreign firm observes $\hat{t}$; by Proposition 1, this signaling schedule is monotonic, and hence invertible; the foreign firm reads the type of government it faces from the signal and responds accordingly, by offering $(\bar{t}(s), \bar{x}(s))$, the solution to the VER game for government of type s. By definition, this is the optimal response for the foreign firm. The domestic firm is always on its best response function (4), and so it too optimizes. A complete proof is provided in the Appendix.

The types that prefer the tariff (s low) impose the optimal tariff/optimal response combination $(\hat{t}(s), \hat{x}(s))$ by rejecting any offer of a VER. The types that would prefer to share the surplus available under a VER instead use the preliminary determination to signal that they would accept an undertaking to reduce exports. Such a government signals $\hat{t}(s)$; it is immediately clear which type sends such a signal. The optimal response for the foreign firm is to offer a VER/tariff restriction; since the offer has been constructed to make it preferable for both the foreign firm and the domestic government to accept it rather than reject it, it is accepted and implemented. The preliminary determination acts as a perfect signal about the type of regulator the foreign firm is facing (what the nature of the political pressures it is facing actually are) and what sort of accommodation it prefers. The foreign firm can do no worse than to respond optimally to any tariff offer, but can do better if it offers the VER, and does so when it is encouraged that it will be accepted.

VII. Discussion

In the two-stage process for administering antidumping complaints, the preliminary determination acts as a perfectly separating signal to the foreign firm about the political configuration domestically. The foreign firm, assured that is can do no worse under a VER than under a tariff complies and requests the VER. Voluntary undertakings, then are the

outcomes to the antidumping game under certain political configurations. Governments for which s is low (consumer interests dominate) will opt for duties in the AD game. Moreover, these duties will be low, since government is concerned about the effects of rising prices (at a low enough s, no duty may be imposed—the AD finding is negative). As firm interests rise in influence, the duties imposed under the AD code rise, until $s = s^*$. Then governments switch, and opt for VERs when they are offered. Hence we have an ordering of trade instruments induced by the interaction of the AD procedure and the relative political influence of firm profits. The AD procedure and domestic politics intertwine to affect the optimal choice not only in the levels of but also across instruments.[24]

In addition, the AD-generated VER presented here raises prices, and lowers domestic consumption. Modest price rises lead to increased profits for both firms, an outcome that certainly immiserizes domestic consumers and was not intended by the framers of the AD law. The government, in the form of the trade-regulating agencies, actively engages in negotiations to obtain (and enforce under the threat of the optimal tariff) on behalf of the local firms a collusive agreement with the foreign firm. Government bargains with the foreign firm over how the total revenue available can be increased, and how to split the market. A well-known case where the AD procedure resulted in a negotiated market sharing agreement was the 1986 U.S.–Japan Semiconductor Trade Arrangement.

When an AD case is settled by the use of a VER, the model predicts that the volume trade will shrink by more than if the same case were settled by the levying of duties. This phenomenon is identified empirically by Prusa (1992), while Staiger and Wolak (1994) establish that in general, AD cases that are suspended (usually as a result of agreed undertakings by the foreign firm) yield reductions in the volume of

trade of a similar magnitude to those occurring under antidumping duties.[25]

The equilibrium generates behavior that is substantiated by the data presented earlier. Firstly, VERs act as a substitute for tariffs, and do so to the benefit of both players (certainly none are worse off). Secondly, the VER is the outcome of the administrative procedure used in investigating the antidumping accusations in exactly those instances where the agency is partly vulnerable to political pressure. The logic of this outcome strongly resembles the patterns observed by Bhagwati (1988), Messerlin (1987) and Finger et al. (1982).

Michael O. Moore (1994) provides a description of the process that lead to the 1982 VER for steel negotiated with the EC. A politically influential industry experienced a decline in employment of 25 percent in the recession of 1981–82, and import market share rose to 21.8 percent, exceeding 20 percent for the first time. U.S. producers filed 33 AD petitions against the EC as well as Brazil and Romania during the same period. The ITC made preliminary determinations in the affirmative in 18 of these petitions; the Reagan administration then entered negotiations for a VER. An agreement was reached in October 1982 limiting EC exports to 5.5 percent of the U.S. market; in return the U.S. firms dropped their cases.

Finger et al. (1982) show that in the cases under the AD procedure between 1975 and 1979, domestic political influences were the dominant influence in findings by the ITC of injury. They found that the size of the industry (in particular, employment levels and to a lesser degree industry concentration) as a proxy for political influence was a significant determinant of a positive injury finding. Moreover, the political factors were of greater significance than the technical determinants (an estimation of the comparative costs of production). These results are indicative of the importance of the political parameters. Further research in this direction is necessary. Essentially, an important empirical verification of

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[24] The literature on domestic politics and the endogenous choice across instruments is discussed in some detail elsewhere (Rosendorff, 1996).

[25] Staiger and Wolak do not test for the possibility that one is larger than the other, and Prusa's model is ambiguous on this question.

the model would investigate the relationship between the political might of the industry and its special interests and the type and size of protection it receives.

It has been suggested by some authors (Feenstra et al., 1990) that the occurrence of VERs is associated with the existence of asymmetric information, and in particular that the important deliberations by the agency occurs behind closed doors. This allows "undesirable" political influences to appear. Suggested policy has been to open this process to public scrutiny, and then such undesirable influences will be checked. The model presented here takes issue with this policy prescription. The public knows that the policy maker must balance consumer and producer demands, but the rational agency finds the point that does just balance these interests in equilibrium, even if this is done behind closed doors. Making this point of balance public information at that point will not cause its location to be changed for it is already located at the point that maximizes aggregated constituency interests. Hence in this model, the VER appears in both the private and public information cases, as long as it is recognized that political consequences will be taken into account by the agency in both cases. One can then not blame the existence of the VER on the private machinations of the policy makers; rather the two-stage AD procedure must be brought into question.

VIII. Conclusion

This paper establishes two important results. Firstly, a VER is preferred to a tariff by a government concerned about electoral returns when the weight on industry profits is large (ownership of stock in the firm is widely distributed). The second result: if the foreign firm is unsure of the exact nature of this political pressure, the antidumping code provides the opportunity for a complete transfer of the relevant information; the foreign firm, after receiving a preliminary determination in the form of a tariff/quota combination responds optimally by offering and acquiescing to a VER if one is accepted, or continuing to respond optimally to the optimal tariff if the VER is rejected.

The regulating authority must balance the demands of the special interest group lobbying for the tariff with the attendant losses associated with higher prices. The outcome is uncertain, to the foreign exporter, for the U.S. regulating agency is better informed about the weight it places on the profit of the local industry versus the consumer-welfare effects. These outcomes, determined by the political vulnerability to the lobbying activity and the costs of implementing the tariff mirror those observed in the antidumping actions in both the U.S. and the EC, and explain the prevalence of a nontariff barrier that is not consistent with the GATT. This GATT-inconsistency is due to the ability to impose a preliminary tariff.

Three other results are established. Firstly, the VER generates increased profits for both the local firm and the foreign firm (or at least no reduction in profits relative to the optimal tariff equilibrium). The antidumping code then leads to collusive outcomes, and to levels of output for each firm that were not otherwise possible. The antidumping procedure does not therefore merely reallocate the rents between firms across international borders (as a tariff does in Brander and Spencer [1985]) but rather the government is actively involved in the negotiation over the optimal collusive agreement.

Secondly, the VER reduces the volume of trade by an amount greater than the restriction the expected duty would produce. That is the foreign firm and the trade regulating authority agree to restrict trade to a level of imports lower than the mere optimal tariff would imply. Empirical evidence (Prusa, 1992; Staiger and Wolak, 1994) suggests that suspensions of antidumping petitions as a result of settlements (voluntary undertakings) are associated with significant reductions in the observed volume of trade, and are of the same order of magnitude as the effect of duties; further empirical work is necessary to establish the finer distinction suggested here.

Thirdly, on occasion duties are imposed (the optimal tariff); on others a VER is agreed to. The choice across instruments is determined by the political attributes—the influence firm profits bring to bear over the interests of consumers. An ordering of trade policies is thus established.

The source of such "undertakings" is clearly the desire of the administration to be seen at home and abroad as in favor of "free trade," while protecting local industry at the same time. Such an administration has found a way to utilize the procedures of what is perceived to be a legitimate countermeasure to foreign dumping, to both have its cake and eat it; to protect local industry without evoking the ire of the local electorate or the international community involved in multilateral trade negotiations. The quotations from the New York Times at the start of this paper confirms this attitude. What is more, the Japanese in this instance recognized this and voluntarily agreed, given the strategic nature of the problem. A Japanese Minister of Trade and Industry, Michio Watanabe suggested that the decision to voluntarily reduce the number of cars exported to the United States (to reduce market share) was made in the national interest after a due consideration of bilateral economic and political conditions.

It is generally perceived that tariffs are in fact the preferred trade barrier; they are easy to enforce, and earn revenues for the state. VERs by comparison are difficult to monitor and are relatively expensive. This model brings the political environment to bear on the economic decisions of actors and shows that nevertheless, the VERs may be preferred when the clout of the industry is large.

If VERs are the outcome of the AD procedure, another question emerges: "Why do countries have antidumping laws at all?" After all, they raise prices and encourage collusion. Recent explanations rely on the fact that anticipated or expected VER or AD action can change current firm behavior (Yano, 1989; Anderson, 1992; James D. Reitzes, 1993), and that this may be welfare improving. This paper provides an alternative explanation: the AD procedure encourages the formation of VERs in exactly those instances where the electoral returns from a VER exceed those from the optimal duties that would otherwise be imposed. The laws are put in place by politicians who require mechanisms the provide the opportunities to create policy that maximizes their electoral returns. The AD procedure is a mechanism that implicitly creates VERs in exactly those instances where a VER would improve the electoral objectives of politicians over and above that which is available when using tariffs alone.

It remains important, however, that when the GATT articles are written to allow for the use of retaliatory measures in the case of unfair trade, that these measures strongly encourage the use of tariffs over other measures. They are more transparent and more easily brought under international scrutiny. Nevertheless, the unintended consequences of encouraging VERs as a solution to the protectionist pressures while maintaining a political position of "free trade" is achieved under the GATT-consistent law. For this reason, the Reagan administration was able to satisfy an important constituency while maintaining the appearance of dedication to open trade.

APPENDIX

PROOF OF COROLLARY 1:

Totally differentiating (7) with respect to t and s yields $0 = (\partial G_t^s / \partial t) dt + (\partial G_t^s / \partial s) ds$. Then $d\hat{t}/ds = -(\partial G_t^s / \partial s)/(\partial G_t^s / \partial t)$. The second-order condition from the government's maximization problem implies $\partial G_t^s / \partial t < 0$ (from the sum of concave functions). Then sign $\hat{t}_s$ = sign $\partial G_t^s / \partial s$ = sign$[yp_t + y_t(p - c)]$ which is positive since $p_t = p' X_t > 0$ and $y_t > 0$. That is $\partial G_t^s / \partial s > 0$ and so $\hat{t}_s > 0$. Consequently, $\hat{x}_s = \hat{x}_t \hat{t}_s < 0$ since $x_t < 0$ from the stability conditions.

PROOF OF PROPOSITION 2:

Consider the domestic government first:

$$\frac{dt}{dx} = -\frac{G_x^s}{G_t^s}$$

$$= -\frac{1}{x}[p'(1 + y_x)(y(s - 1) - x)$$

$$+ sy_x(p - c) + t]$$

which is equivalent to $dt/dx = -(p'/x)[sy - (1 + y_x)(x + y) + t/p']$ using (5). Consider

$$t < p'[(1 + y_x)x - y] \Leftrightarrow y(2 + y_x)$$

$$- (1 + y_x)(x + y) > -t/p'.$$

Now $s > 2 + y_x \Rightarrow sy - (1 + y_x)(x + y) > y(2 + y_x) - (1 + y_x)(x + y) > -t/p'$. That is $sy - (1 + y_x)(x + y) + t/p' > 0 \Rightarrow dt/dx > 0$. The foreign firm indifference curves have slope $dt/dx = (1/x)[p'x(1 + y_x) - t + p - c] > 0$ since $p'x(1 + y_x) - t > 0$ by the condition and $p - c \geq 0$ (profits are nonnegative).

PROOF OF PROPOSITION 3:

We need to show that the foreign firm can do strictly better than the tariff game equilibrium level of profits if both x and t fall and the individual rationality constraint is satisfied, that is, ensuring $G^s(\bar{x}, \bar{t}) \geq G^s(\hat{x}, \hat{t})$. We claim $d\pi^*|_{(\hat{x},\hat{t}),dG^s(\hat{x},\hat{t})=0} < 0$ as we allow x and t to fall slightly.

Now $d\pi^* = dx(p - c - t + xp'(1 + y_x)) - xdt$ and $dG^s = -p'(1 + y_x)(x + y(x))dx + s[y_x(p - c)dx + yp'(1 + y_x)dx] + tdx + xdt$. Then $dG^s|_{(\hat{x},\hat{t})} = 0$ implies

$$[-p'(1 + y_x)(\hat{x} + y(\hat{x})) + s[y_x(\hat{p} - c)$$
$$+ \hat{y}p'(1 + y_x)] + \hat{t}] dx = -\hat{x}dt.$$

Therefore

$$d\pi^*|_{(\hat{x},\hat{t}),dG^s(\hat{x},\hat{t})=0} = [\hat{p} - c - \hat{t} + \hat{x}p'(1 + y_x)$$
$$- p'(1 + y_x)(\hat{x} + y(\hat{x})) + s[y_x(\hat{p} - c)$$
$$+ \hat{y}p'(1 + y_x)] + \hat{t}] dx$$

$(d\pi^*/dx)|_{(\hat{x},\hat{t}),dG^s(\hat{x},\hat{t})=0} = -p'\hat{y}(1 + y_x) + sy_x(\hat{p} - c) + s\hat{y}p'(1 + y_x) + (\hat{p} - c)$. With (5) we have $(d\pi^*/dx)|_{(\hat{x},\hat{t}),dG^s(\hat{x},\hat{t})=0} = -p'\hat{y}(1 + y_x) - sy_x\hat{y}p' + s\hat{y}p'(1 + y_x) - \hat{y}p' = -2\hat{y}p' + s\hat{y}p' - \hat{y}p'y_x < 0$ if and only if $s\hat{y}p' < 2\hat{y}p' + \hat{y}p'y_x$. Recalling that $p' < 0$,

$$\left.\frac{d\pi^*}{dx}\right|_{(\hat{x},\hat{t}),dG^s(\hat{x},\hat{t})=0} < 0 \text{ if}$$

$$\text{and only if } s > 2 + \left.\frac{dy}{dx}\right|_{(\hat{x},\hat{t}),}.$$

PROOF OF PROPOSITION 4:

Recall that $dX/dx = 1 + y_x$. From (5), $y_x = -(1 + y_x) + (p - c)p''(1 + y_x)/(p')^2$. Then $1 + y_x = 1/(2 + y(p''/p'))$. From the

stability conditions of the Cournot competition (footnote 15), $\pi_{yx} = p' + yp'' < 0$. Hence $1 + yp''/p' > 0$ (since $p' < 0$). Therefore $2 + yp''/p' > 1$ and $0 < 1 + y_x < 1$. Hence $dX/dx > 0$ and $dy/dx < 0$. Then $dp/dx = p'(dX/dx) < 0$ and $d\pi/dx = y_x(p - c) + y(dp/dx) < 0$.

PROOF OF PROPOSITION 5:

The pair $(\hat{t}(s), \hat{x}(s))$ is defined as in the tariff game (equation (1)) and the pair $(\bar{t}(s), \bar{x}(s))$ is the solution to the problem described in equation (8). In addition, $x = x(y, t)$ and $y = y(x, t)$ are the best response functions to the tariff game (4). Equilibrium payoffs are $G^s(\bar{t}(s), \bar{x}(s))$, $\pi^*(\bar{t}(s), \bar{x}(s))$ and $\pi(\bar{t}(s), \bar{x}(s))$ when $s \geq s^*$ and are $G^s(\hat{t}(s), \hat{x}(s))$, $\pi^*(\hat{t}(s), \hat{x}(s))$ and $\pi(\hat{t}(s), \hat{x}(s))$ when $s < s^*$.

Consider the government first. Suppose a government of type $s \geq s^*$ plays $(\hat{t}(s), R)$ instead of $(\hat{t}(s), A)$. Then the deviation payoff is $G^s(\hat{t}(s), \hat{x}(s)) \leq G^s(\bar{t}(s), \bar{x}(s))$ (the equilibrium payoff) for all $s \geq s^*$ by Proposition 3. Suppose a government of type $s < s^*$ plays $(\hat{t}(s), A)$ instead of $(\hat{t}(s), R)$. Then the deviation payoff is $G^s(\bar{t}(s), \bar{x}(s)) \leq G^s(\hat{t}(s), \hat{x}(s))$ (the equilibrium payoff) for all $s < s^*$ by Proposition 3.

Suppose a government of type s plays (t', A) for $t' \neq \hat{t}(s)$. Define $s' = \hat{t}^{-1}(t')$, that is type s is emulating type s'. By Proposition 1, the signaling schedule $\hat{t}(s)$ is monotonic, and hence invertible. Then the deviation payoff $G^s(\bar{t}(s'), \bar{x}(s')) \leq G^s(\bar{t}(s), \bar{x}(s))$ from (8). If $s \geq s^*$ equilibrium payoff is $G^s(\bar{t}(s), \bar{x}(s))$ and there is no gain from deviation. If $s < s^*$, $G^s(\bar{t}(s), \bar{x}(s)) \leq G^s(\hat{t}(s), \hat{x}(s))$ by Proposition 3. Then $G^s(\bar{t}(s'), \bar{x}(s')) \leq G^s(\hat{t}(s), \hat{x}(s))$.

Suppose a government of type s plays (t', R) for $t' \neq \hat{t}(s)$. Then the deviation payoff $G^s(\hat{t}(s'), \hat{x}(s')) < G^s(\hat{t}(s), \hat{x}(s))$ (the equilibrium payoff for all $s < s^*$) by Proposition 1. If $s \geq s^*$, the equilibrium payoff is $G^s(\bar{t}(s), \bar{x}(s)) \geq G^s(\hat{t}(s), \hat{x}(s))$ from (8) and $G^s(\hat{t}(s), \hat{x}(s)) > G^s(\hat{t}(s'), \hat{x}(s'))$ from Proposition 1. Therefore $G^s(\hat{t}(s'), \hat{x}(s')) < G^s(\bar{t}(s), \bar{x}(s))$.

The foreign firm plays $(\bar{t}(s), \bar{x}(s), \hat{x}(s))$ after learning s in equilibrium. Suppose instead it plays $(t', x', \hat{x}(s))$ where $t' \neq \bar{t}(s)$

and $x' \neq \bar{x}(s)$. If government accepts, the foreign firm receives $\pi^*(t', x') \leq \pi^*(\bar{t}(s), \bar{x}(s))$ since $(\bar{t}(s), \bar{x}(s))$ solves (8) and the government accepts in equilibrium. Note that if the deviation is accepted, this is a type of government who would accept in equilibrium as well, since $(\bar{t}(s), \bar{x}(s))$ solves (8). If the government rejects the deviation offer then the foreign firm receives $\pi^*(\hat{t}(s), \hat{x}(s))$. If government rejects in equilibrium, then there is no gain from deviation; if government accepts in equilibrium, the foreign firm receives $\pi^*(\bar{t}(s), \bar{x}(s)) \geq \pi^*(t', x')$ since $(\bar{t}(s), \bar{x}(s))$ solves (8). If the foreign firm plays (t, x, x') where $x' \neq x(y, t)$ for any t and x, then the foreign firm is not playing a best response in the tariff game; x' lies off the best response function (4).

Finally, if the domestic firm plays something other than $y = y(x, t)$, it too is not playing a best response on (4).

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