Journal of Economic Integration
9(2), June 1994, 260-289

Pricing Behavior in the Presence of Antidumping Law

Thomas J. Prusa*
State University of New York at Stony Brook

Abstract

This paper examines the effect of antidumping (AD) law on the pricing behavior of foreign and domestic firms prior to the filing of an AD action. AD law affects firms in very different ways – almost always distorting the foreign firm's strategy but often not altering the domestic firm's. We show that AD law creates a price floor for the foreign firm and causes it to raise its price. The domestic firm's response is significantly more complicated, in many instances resulting in feigned injury. These diverse effects imply that AD law has important welfare consequences even if duties are never levied.

I. Introduction

Recent years have witnessed a growing interest in the rationale for, and the effects of, antidumping (AD) law. This newfound interest in AD law (as opposed to the more traditional interest in why firm dump) lies primarily in the remarkable worldwide increase in the use of AD law in recent years – between 1980 and 1985 more than 1600 AD actions were initiated worldwide ⟨Tharakan [1991]⟩.

---

* Department of Economics, S.U.N.Y. at Stony Brook, Stony Brook, New York 11794-4384, U.S.A. Telephone: (516) 632-7563; Fax: (516) 632-7516; I would like to thank the Japan Foundation Center for Global Partnership and the Harry and Lynde Bradley Foundation for financial support. I received helpful comments from Pradeep Dubey, Rob Feenstra, Jim Hartigan, John Hillas, Mike Leidy, and Bob Staiger.

Bhagwati [1988] was one of the first to raise the possibility that this GATT-sanctioned trade law is being used in an illegitimate manner. He argues that firms can use the AD investigations to harass foreign rivals and, if successful, to restore the protection lost with the multilateral tariff reductions.[1] Hoekman and Leidy [1989] extend Bhagwati's argument claiming that the vagueness of the rules governing AD procedures have made AD actions a substitute for the more difficult to obtain safeguard protection, *i.e.*, that dumping duties are being levied when other forms of GATT-sanctioned protection are more appropriate.[2]

Prusa [1993] argues that receiving protection is only part of the reason why firms file AD actions. He argues that many firms file AD actions without any intent of obtaining duties against their foreign rivals. Rather, it is more desirable if the foreign and domestic industries negotiate a settlement. From this perspective the increase in AD filings is especially disturbing since cases with very dubious merit (*i.e.*, with very small probability of winning protection) can have sizeable affect on welfare.[3] Staiger and Wolak [1991] also use the fact that approximately one-third of AD cases are settled to motivate their model of AD law as a cartel stabilizing punishment mechanism.

All of these papers, however, attempt to explain the effects of AD law once a case has been filed. In this paper, attention is focused on the effects of AD law prior to the filing of a case. We show that the increased incidence of AD petitions should be only one – and possibly the least important – of the concerns about AD law. AD law can have significant effects on firms' strategies, prices, and profits even if duties are never levied. The fact that AD law changes firms' behavior, of course, is not entirely unexpected. In fact, the original intention of AD law was to deter foreign firms from engaging in

---

1. Finger [1981] and Herander and Schwartz [1984] provide early empirical evidence that AD law might be used to harass foreign competitors.
2. Finger, Hall, and Nelson [1982] argue that the rules governing escape clause protection are even more vague than those governing AD protection. Hansen and Prusa [1993] argue that escape clause protection is nonetheless more politically difficult to provide since GATT rules allow foreign retaliation.
3. For another perspective on the welfare implications of antidumping law see Webb [1992].

predatory pricing, so policy makers would likely view the law as a failure unless some response was induced.

In general, however, AD law can have a far more unexpected consequences than expounded in public debates. According to GATT rules, duties can only be levied if two criteria are satisfied "less than fair value" sales (by the foreign industry) and "injury" (to the domestic industry). As it turns out, the likelihood that these criteria are satisfied depend significantly on how domestic governments interpret the GATT guidelines. In fact, given the generous latitude that governments have in implementing the law, it seems clear that AD law is no longer implemented in a way to achieve its original purpose. In many circumstances, the rules are so nebulous that it indeed seems entirely likely that governments are using AD protection as "GATT consistent" protectionism. For example, given current U.S. procedures, foreign firms can be guilty of dumping even if they charge exactly the same prices both at home and abroad.[4]

The cavalier manner which many governments use AD law suggests that foreign firms must be concerned about AD actions, even if they are confident they are not dumping. Foreign firms, however, can influence the likelihood that dumping actions will be brought against them (and the likelihood that such actions will be rejected) by changing their pricing strategy. Not surprisingly, this involves raising the price charged in the domestic market. More interesting, domestic firms can also influence the likelihood of dumping duties by changing their pricing strategies. However, in many circumstances it will not pay the domestic firm to change its behavior. When AD law does influence the domestic firm's behavior, it can result in either higher or lower prices. Either way adversely affects the domestic firm's profits – and increases the likelihood of an affirmative injury determination. In a sense, the domestic firm attempts to induce AD protection by feigning injury.

Both foreign and domestic firms alter their behavior in order to influence the outcome of a (threatened) case. Specifically, the foreign firm attempts to

4. Individual export transactions are compared with the foreign firm's mean home market price. Thus, even if the same price is charged in both markets at every point in time, a firm can be found guilty of dumping as long as there is some variance in prices over time.

decrease, and the domestic firm to increase, the probability that duties will be levied. Interestingly, even though both firms' strategies suggest they are willing to sacrifice short-run profit for long-term benefits, there are circumstances when both firms can earn higher current period profit. In this sense, AD law facilitates collusive behavior. The threat of impending legal action reduces the rivals' coordination problem and promotes tacit collusion. As a result, *both* domestic and foreign firms may prefer to operate in an environment where there is the threat of an AD action. Thus, AD law can have a deleterious welfare effect even if duties are never levied.

The approach taken in here is related to several recent papers. Leidy and Hoekman [1990] investigate the foreign firm's production response to AD law under exchange rate uncertainty and show that the different definitions of less than fair value (LTFV) sales can lead to different production responses. Fischer [1992] also focuses on the effects of the LTFV determination on the firms' actions and shows that prices will be driven up. Neither of these papers, however, incorporates the injury criterion into their analysis. Ignoring the injury determination is significant since, in practice, of the two determinations, the LTFV decision involves far less uncertainty. For example, in the U.S. only 6% of AD cases since 1980 have not satisfied the LTFV determination.[5] By contrast, since 1980, 47% of final injury decisions were affirmative and 53% negative, suggesting that the firms' marginal impact on the injury decision could be quite significant. As we will show, AD law has its more prominent effects when there is significant uncertainty over the decision. AD actions can also reveal a great deal of information about the foreign rival. Hartigan [1993a] shows that AD law can either enhance or inhibit the foreign firm's ability to signal its costs. In a related paper, Hartigan [1993b] discusses how an AD action allows foreign and home firms to share information about costs and examines the welfare implications of such information revelation. Finally, Leidy [1993] discusses how the vagueness of the injury criterion can lead to manipulation by the domestic firm. Leidy finds that AD law can lead to "spurious injury". Importantly, Leidy assumes injury is positively related to sales, and thus finds that the domestic firm will

5. See Boltuck and Litan [1991] for an excellent discussion of the problems calculating LTFV sales.

always seek to manipulate the injury decision. By contrast, in this paper, AD law has a more subtle effect on the domestic firm's behavior.

The paper is organized as follows. In the next section we present the model and describe the game, relating the modeling assumptions to the actual features of AD actions. In Section III we characterize the Nash equilibrium without AD law while Section IV derives the Nash equilibrium pricing strategies with AD law. The model is extended to incorporate the foreign firm's home market pricing decisions in section V. A few concluding comments are made in section VI.

II. The Model

The section will setup a two period duopoly model which we can use to analyze the strategic aspects of AD law. For expositional convenience, the model will be kept as simple as possible. We begin by assuming that there are two firms, one domestic and one foreign. We will denote foreign values with a star(*). In each period, the firms produce differentiated products which are close, but not perfect substitutes for one another. The domestic firm services the domestic market with local production while the foreign firm exports to the domestic market. Let P_t and $Q_t \equiv Q(P_t^*, P_t)$ denote the domestic firm's price and quantity, respectively, in period t, $t = 1, 2$; P_t^* and $Q_t^* \equiv Q^*(P_t^*, P_t)$ are similarly defined for the foreign firm.

In the first part of the paper we will ignore the foreign firm's behavior in its home market. This simplification can be justified on two grounds. First, it avoids needless complication without much cost. As will be shown in section V, the key strategic effects of AD law are present whether or not the home market is explicitly modeled. Second, in many AD actions, the foreign firm's home market pricing is not directly relevant to the investigation. This is the case, for instance, when a constructed value approach is used to calculate LTFV margin. Under the constructed value approach the government agency will calculate a home market price based upon its estimates of costs and "reasonable" profit rates. Also, when home market sales are too small (or do not exist), or when the exporter operates in a centrally planned economy, the LTFV calculation will be based on sales of a comparable product sold by a third party in another market. Certainly in these cases the foreign

firm's home market behavior does not effect the LTFV determination.

When there are no dumping duties, the domestic firm will earn profit $\Pi_t(P_t^*, P_t)$ in period t, while the foreign firm will earn $\Pi_t^*(P_t^*, P_t)$. Without the threat of an AD action the domestic and foreign firms simply maximize their discounted two-period profit. Letting δ denote the common discount factor we can write the domestic firm's problem as

$$\max_{\{P_1, P_2\}} \Pi = \Pi_1(P_1^*, P_1) + \delta \Pi_2(P_2^*, P_2) \tag{1}$$

and the foreign firm's problem as

$$\max_{\{P_1^*, P_2^*\}} \Pi^* = \Pi_1^*(P_1^*, P_1) + \delta \Pi_2^*(P_2^*, P_2) \tag{2}$$

In order to understand how AD law affects the firms' behavior we need to understand how AD law is implemented. GATT rules *require* that two criteria be satisfied before duties be levied, a LTFV determination and an injury determination. However, beyond specifying these criteria, GATT gives domestic governments considerable discretion in implementing the law. In some countries a single agency makes both determinations while in others have two agencies involved. For instance, in the U.S., the Department of Commerce makes the LTFV determination while the International Trade Commission makes the injury determination. In addition, the interpretation of what is meant by "injury" and the rules for calculating LTFV sales vary considerably from country to country, and even from case to case within a given country.[6] What is incorporated in this model, then, is broad characterization of distortions created by AD law, rather than any precise description of any particular country's implementation.

We will say that the foreign firm has sold at LTFV if its price in the domestic market during the first period is less than the "observed" home market price. In other words, LTFV sales are said to have occurred if $P_1^* < P_H^*$, where P_H^* denotes the observed home market price (in domestic currency). The observed home market price may not equal the true home market price for a variety of reasons. For instance, in a world with flexible

6. Those interested in an excellent summary and cross-country comparison of AD procedures should consult Jackson and Vermulst [1989].

exchange rates there is considerable uncertainty over how currency conversion will affect the *ex post* home market price ⟨Leidy and Hoekman [1990]⟩. Or, as typically happens, adjustments are made to the home market price during the course of the LTFV determination. And, as discussed above, the commonly used "constructed value" method also gives rise to uncertainty over the home market price.

Our analysis of the strategic implications of AD law can be carried out most expeditiously if we assume that P_H^* is determined by a constructed value calculation. In section V we will discuss how the results change if we allow the foreign firm's home market pricing decision to influence P_H^*. At this point, however, we will assume that both the domestic and foreign firms know the general rules by which P_H^* is constructed but do not know P_H^* with certainty. In other words, the distribution governing P_H^*, $F(\cdot)$, is common knowledge. We also assume that $F(\cdot)$ is twice-continuously differentiable on support $[0, \bar{P}^*]$. Note that only the foreign firm can influence the LTFV decision.[7] By raising (lowering) the price it charges during the first period, the foreign firm can decrease (increase) the likelihood of a LTFV determination. While not explicitly modeled here, the upper-bound $\bar{P}^*$ can be thought of as a parameter which is set at some earlier stage of the policy-making process (*i.e.*, $\bar{P}^*$ is exogenous to the play of this game). For instance, in the U.S., $\bar{P}^*$ might be set by Congress when trade legislation is enacted. Over time, amendments to the statute might raise (or lower) the upper-bound.[8]

The probability of a LTFV determination can be written as

$$\rho^L(P_1^*) = \int_{P_1^*}^{\bar{P}^*} F'(x)dx.$$

Clearly, $\rho_1^L(\cdot) \equiv d\rho^L(\cdot)/dP_1^* \leq 0$.

An injury determination must also be made before duties can be levied. In general, many economic factors – profits, market share, employment, capacity utilization, *etc.* – are considered when determining injury; more-

7. If the firms competed in quantities, then the domestic firm could influence the LTFV decision by increasing its quantity sold. Fischer's [1991] model highlights the distortions created by the LTFV determination.

8. One sensible interpretation of $\bar{P}^*$ is the price that eliminates the foreign firm from the domestic market (*i.e.*, gives the domestic firm a monopoly).

over, the relative importance of each factor varies from year to year and from case to case.[9] However, the domestic firm's profit level is almost without fail an important element of the injury determination. For simplicity, we will say that the domestic firm has been injured if its profits fall below a specified level, Π^I. That is, injury will be said to have occurred if

$$\Pi_1(P_1^*, P_1) \leq \hat{\Pi}^I = \Pi^I + \mu. \tag{3}$$

The injury criterion specified in (3) establishes a minimum profit level. However, depending on factors beyond the firms' control – the political environment, the current makeup of the agency, the general state of the economy, *etc.* – the precise size of the minimum profit level will vary. In particular, we will assume that the random component of the injury decision is described by an additive stochastic term μ, which is drawn from a twice-continuously differentiable distribution $G(\cdot)$. We assume that $G(\cdot)$ is common knowledge and has zero mean.

Note that both firms can influence the injury determination *via* their ability to influence the size of the domestic firm's first period profit. We can express the probability that injury occurs as

$$\rho^I(\Pi_1(P_1^*, P_1);\ \Pi^I) = \int_{\Pi_1(P_1^*, P_1) - \Pi^I}^{\infty} G'(x)dx.$$

Let $\rho_1^I(\cdot) \equiv \partial \rho^I(\cdot)/\partial \Pi_1$ and note that $\rho_1^I(\cdot) \leq 0$. We will also assume that $\rho_{11}^I(\cdot) \equiv \partial^2 \rho^I(\cdot)/\partial \Pi_1^2 \leq 0$.

Given this set-up, the timing of the game with AD law is as follows: (1) The firms announce their first period prices, $\{P_1^*, P_1\}$. (2) First period sales, $\{Q_1^*, Q_1\}$, and profits, $\{\Pi_1^*, \Pi_1\}$, are realized. (3) If it desires, the domestic firm can initiate an AD investigation at a cost of C. If a petition is initiated, the foreign firm defends itself at cost C^*. (4) If a petition is initiated, the government determines whether or not both criteria are satisfied and announces its decision. (5) If dumping is found, a specific duty of $(P_H^* - P_1^*)$ is charged; the foreign firm collects only P_1^*. (GATT rules restrict the duty

9. Boltuck [1991] provides an excellent summary of the factors used by the U.S. International Trade Commission when determining injury.

to only be large enough to offset the LTFV margin.)[10] If dumping is not found, the firms announce their second period prices, $\{P_2^*, P_2\}$. (6) Second period sales, $\{Q_2^*, Q_2\}$, and profits, $\{\Pi_2^*, \Pi_2\}$, are realized.

III. Nash Equilibrium without Antidumping Law

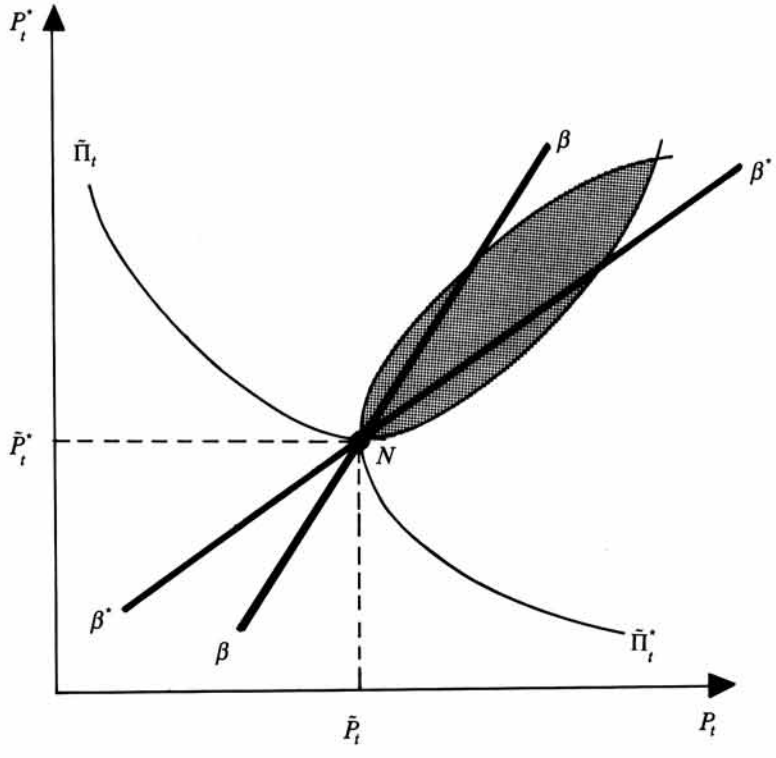
The model developed in the previous section allows a simple characterization of Nash equilibrium without AD law. Without the threat of an AD investigation the firms' optimal strategy is simply to maximize their discounted two-period profit functions, as specified in (1) and (2), respectively. Hence, the firms simply maximize their profit on a period-by-period basis. We will assume that there exists a unique, stable Nash equilibrium in this benchmark scenario and that in equilibrium both firms' prices and output are strictly positive.[11] In particular, assume that profit functions are twice-continuously differentiable and strictly concave in their own price, and that the best response functions are contractions. Denote the domestic firm's best response function as $\beta(P_t^*)$, and let $\beta^*(P_t)$ denote the foreign firm's best response function. The Nash equilibrium is defined by the two-tuple $(\tilde{P}_t^*, \tilde{P}_t)$ which satisfies $\beta^*(\tilde{P}_t) = \tilde{P}_t^*$ and $\beta(\tilde{P}_t^*) = \tilde{P}_t$.

Figure 1 depicts the benchmark equilibrium. The best response function $\beta(P_t^*)$ defines the domestic firm's price that allows the highest iso-profit loci to be reached, given P_t^*. For instance, if the foreign firm charges $\tilde{P}_t^*$ the domestic firm's best response is $\tilde{P}_t = \beta(\tilde{P}_t^*)$, which generates profits of $\tilde{\Pi}_t = \Pi_t(\tilde{P}_t^*, \tilde{P}_t)$. The foreign firm's best response function, $\beta^*(P_t)$, can be interpreted in a similar fashion. In this simple Bertrand game, the reaction functions are positively sloped. That is, a price increase by the one competitor encourages a price increase by the other. The Nash equilibrium is at point N. The shaded region defines the prices which provide both firms with at least as great of profit as they earn under $\{\tilde{P}_t^*, \tilde{P}_t\}$.

---

10. The practice in the U.S. is to set the AD duty equal to the Department of Commerce's calculated dumping margin. In the EC, the AD duty is set equal to the lesser of the dumping margin and a duty sufficient to eliminate injury. It is only a minor extension to the current model to incorporate the EC's duty level.
11. Friedman [1983] discusses the sufficient conditions for these conditions to hold.

Figure 1
Bertrand-Nash Equilibrium – No AD Law



IV. Nash Equilibrium with Antidumping Law

In general, the threat of an AD action implies that the strategy of simply maximizing profit on a period-by-period basis will not be optimal; rather, the firms will want to incorporate their ability to influence expected second period profits in their first period decision.

Solving the model recursively, we begin by analyzing the second period pricing decisions. At the beginning of period two, firms know whether or not duties have been levied. If duties have not been levied, the firms' simply maximize second period profits, just as they did without AD law. Denote this equilibrium as $\{\tilde{P}_2^*, \tilde{P}_2\}$. In this case, the firms will earn profits $\Pi_2(\tilde{P}_2^*, \tilde{P}_2)$ and $\Pi_2^*(\tilde{P}_2^*, \tilde{P}_2)$, respectively. If, on the other hand, dumping duties have been imposed, the foreign firm's price is P_H^*. In this case, the domestic firm sets a price $P_H = \beta(P_H^*)$ and will earn profits $\Pi_2(P_H^*, \beta(P_H^*))$.

If injury is found, then the domestic firm's benefit from filing the AD

action depends on the observed home market price, P_H^*. Let $\Delta(P_H^*)$ denote the domestic firm's gain when P_H^* is the calculated home market price,

$$\Delta(P_H^*) \equiv \Pi_2(P_H^*, \beta(P_H^*)) - \Pi_2(\tilde{P}_2^*, \tilde{P}_2) \tag{4}$$

Let $E\Delta(P_1^*)$ denote the expected gain to the domestic firm from an affirmative LTFV determination,

$$E\Delta(P_1^*) \equiv \int_{P_1^*}^{\bar{P}^*} \Delta(x)F'(x)dx - C. \tag{5}$$

We will assume that $E\Delta(P_1^*) \geq 0$ (*i.e.*, the domestic firm expects to benefit from an affirmative LTFV decision).[12]

We can make similar definitions for the foreign firm. Recall that when dumping duties are levied the foreign firm collects only P_1^* per unit; $(P_H^* - P_1^*)$ is the specific duty. In other words, when dumping duties are levied the foreign firm will earn profits

$$\Pi_2^*(P_H^*, \beta(P_H^*)) - (P_H^* - P_1^*)Q_2^*(P_H^*, \beta(P_H^*)).$$

Let $\Delta^*(P_H^*)$ denote the foreign firm's loss when P_H^* is the calculated home market price, *i.e.*,

$$\Delta^*(P_H^*) \equiv \Pi_2^*(P_H^*, \beta(P_H^*)) - (P_H^* - P_1^*)Q_2^*(P_H^*, \beta(P_H^*)) - \Pi_2(\tilde{P}_2^*, \tilde{P}_2), \tag{6}$$

and let $E\Delta^*(P_1^*)$ denote the expected loss to the foreign firm from an affirmative LTFV determination (inclusive of costs of responding to the petition),

$$E\Delta^*(P_1^*) \equiv \int_{P_1^*}^{\bar{P}^*} \Delta^*(x)F'(x)dx - C^*. \tag{7}$$

As long as the potential duty is sufficiently large (or as long as C^* is sufficiently large), $E\Delta^*(P_H^*) \leq 0$ (*i.e.*, the foreign firm will be hurt by an affirmative LTFV decision).

Given these definitions, we can write the (AD law-distorted) expected two-period profit functions as

$$E\Pi(P_1^*, P_1) = \Pi_1(P_1^*, P_1) + \delta(1 - \rho^I(\cdot))\Pi_2(\tilde{P}_2^*, \tilde{P}_2)$$

12. If C is sufficiently small and if $P_1^* \geq \tilde{P}_2^*$ then it must be the case that $E\Delta(P_1^*) \geq 0$. If, however, the foreign firm's first period price P_1^* is sufficiently low then it is possible that $E\Delta(P_1^*) < 0$. To expedite the presentation we are ruling out this possibility.

$$+\delta\rho^{I}(\cdot)\left\{\int_0^{P_1^*}\Pi_2(\tilde{P}_2^*,\tilde{P}_2)F'(x)dx+\int_{P_1^*}^{\bar{P}^*}\Pi_2(x,\beta(x))F'(x)dx-C\right\}$$

$$=\Pi_1(P_1^*,P_1)+\delta\left\{\Pi_2(\tilde{P}_2^*,\tilde{P}_2)+\rho^{I}(\cdot)E\Delta(P_1^*)\right\}, \quad (8)$$

and

$$E\Pi(P_1^*,P_1)=\Pi_1^*(P_1^*,P_1)+\delta(1-\rho^{I}(\cdot))\Pi_2^*(\tilde{P}_2^*,\tilde{P}_2)$$

$$+\delta\rho^{I}(\cdot)\left\{\int_0^{P_1^*}\Pi_2^*(\tilde{P}_2^*,\tilde{P}_2)F'(x)dx\right.$$

$$\left.+\int_{P_1^*}^{\bar{P}^*}\left\{\Pi_2^*(x,\beta(x))-(x-P_1^*)Q_2^*(x,\beta(x))\right\}F'(x)dx-C^*\right\}$$

$$=\Pi_1^*(P_1^*,P_1)+\delta\left\{\Pi_2^*(\tilde{P}_2^*,\tilde{P}_2)+\rho^{I}(\cdot)E\Delta^*(P_1^*)\right\} \quad (9)$$

As expressed in equation (8), at the beginning of period 1 the domestic firm's expected two-period profit is just the sum of first period profit, $\Pi_1(P_1^*, P_1)$, and expected second period profit, which is just the weighted sum of the profit when duties are not levied, $\Pi_2(\tilde{P}_2^*, \tilde{P}_2)$, and profit when duties are levied. After some rearranging, (8) can be written as the domestic firm's expected two-period profit without AD law plus the expected gain from AD law, $\delta\rho^{I}(\cdot)E\Delta(P_1^*)$. Similarly, the foreign firm's expected two-period profit, equation (8), can be expressed as its profit without AD law plus the expected loss from AD law, $\delta\rho^{I}(\cdot)E\Delta^*(P_1^*)$.

A. The Foreign Firm's Pricing Decision

We begin by looking at the foreign firm's decision. Differentiating (9) with respect to P_1^* yields

$$\frac{\partial E\Pi^*(\cdot)}{\partial P_1^*}=\frac{\partial\Pi_1^*(\cdot)}{\partial P_1^*}+\delta\left\{\rho_1^{I}(\cdot)\frac{\partial\Pi_1^*(\cdot)}{\partial P_1^*}E\Delta^*(P_1^*)-\rho^{I}(\cdot)\Delta^*(P_1^*)F'(P_1^*)\right\}=0 \quad (10)$$

The first term on the right-hand side of (10) is the marginal change in first period profit while the bracketed expression on the right-hand side of (10) is the marginal change in second period profit. An increase in the first period price decreases the probability that dumping duties will be levied by lowering the probability of injury, $\rho_1^{I}(.)$, and LTFV sales, $F'(P_1^*)$. Therefore, the

bracketed expression is nonnegative.

Without AD law, the foreign firm maximizes its profit by setting $\partial\Pi_1^*(\cdot)/\partial P_1^* = 0$. In contrast, with AD law, (10) implies that the foreign firm maximizes profit by setting $\partial\Pi_1^*(\cdot)/\partial P_1^* \leq 0$. In other words, the foreign firm announces a higher first period price than it would without AD law. The foreign firm raises its first period price (relative to the no-AD law level) in order to decreased the probability that the domestic firm will be injured and also to decrease the probability of a LTFV determination. Although raising its first period price beyond its Nash level will lower its first period profit, for any given P_1, the foreign firm is willing to sacrifice first period profit in order to avoid a large profit loss in the second period.

Letting $\beta_d^*(P_1)$ denote the foreign firm's best response function with AD law, we have

Proposition 1: *For any given P_1, the foreign firm will prefer to announce a higher first period price with AD law than without AD law. That is, $\beta_d^*(P_1) \geq \beta^*(P_1)$.*

Figure 2 depicts how the threat of AD duties affects the foreign firm; its best response function, β_d^*, (the shaded curve) shifts up relative to the no-AD law best response function, β^* (the solid curve). From (10) we note that the shift will be larger (i) the greater the marginal decrease in the likelihood of duties and (ii) the more damaging duties will be. For example, $\beta_d^{*\prime}$ depicts a case when there is a more dramatic increase in the foreign firm's pricing strategy.

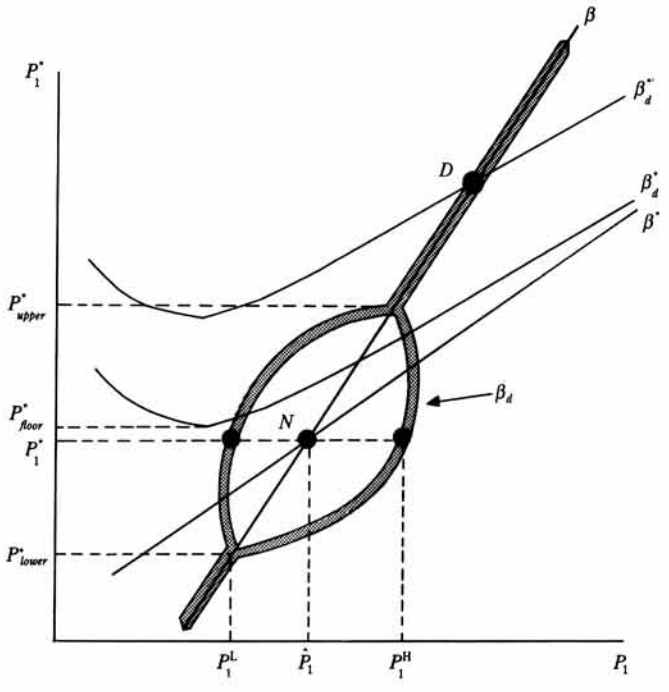
From (10) we also know

Corollary 1: *The threat of an AD action will have no effect on the foreign firm's behavior if the domestic firm charges a sufficiently high price. That is, $\beta_d^* = \beta^*$ if $\beta^*(P_1) > \bar{P}^*$.*

In other words, if the domestic firm charges a sufficiently high price, the foreign firm can charge its profit maximizing first period price, $\beta^*(P_1)$, since there is zero probability of dumping duties being levied (*i.e.*, $\rho^L = 0$). That is, AD law only distorts the foreign firm's behavior if there is some chance of a LTFV determination.

Thus, when $\bar{P}_1^*$ is relatively small AD law will not distort the foreign firm's

Figure 2
Best Responses – With AD Law



Note: Best response functions without AD law are solid curves;
Best response correspondences with AD law are shaded curves

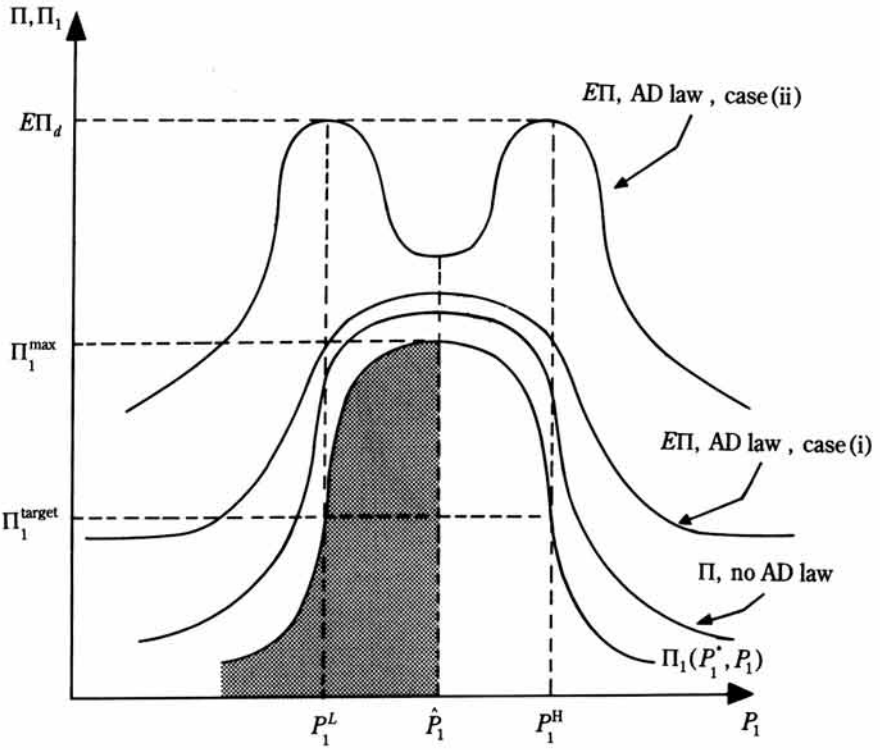
pricing strategy. In general, however, we would expect AD law to have an effect on prices. In particular, AD law has significant effects on the foreign firm behavior at relatively low prices. In contrast to the best response function without AD law (which slopes upwards in price space) there is a region of price-space where the foreign firm finds it optimal to respond to lower domestic firm prices by *raising* its price. Formally,

Corollary 2: *AD law alters the strategic behavior of the foreign firm. In particular, for sufficiently small* P_1 *the foreign firm responds by raising its price when the domestic firm cuts its price. Formally, if* $0 < \rho^I(\cdot) < 1$, *then for* P_1 *sufficiently small,* $\partial\beta_d^*/\partial P_1 \leq 0$.

Following directly from this result is

Corollary 3: *AD law establishes a price floor for the foreign firm's product.*

Figure 3
Domestic Firm's Profit Function



The intuition behind these corollaries is quite sensible. First note that this change in pricing strategy can only occur if the domestic firm is charging relatively low prices, *i.e.*, some $P_1 < \beta(P_1^*)$, *i.e.*, it can only occur in a region to the left of $\beta(P_1^*)$. In this region the domestic firm's first period profits are increasing in its own price. Figure 3, which depicts the *domestic* firm's profit given that the foreign firm sells at price P_1^*, shows why this is the case. The curve labeled $\Pi_1(P_1^*, P_1)$ graphs the domestic firm's strictly concave first period profit function for a given P_1^*. Prices and profits where $P_1 < \beta(P_1^*)$ are depicted by the shaded area in Figure 3.

Consider when the domestic firm charges $\hat{P}_1 \equiv \beta(P_1^*)$. At this price it earns first period profit of $\Pi_1^{max} = \Pi_1(P_1^*, \hat{P}_1)$, which by definition of β is the maximum possible first period profits, given P_1^*. Suppose instead that the domestic firm were charging some price in the shaded region, $P_1 < \hat{P}_1$. In this region, an increase in the domestic firm's price increases its first period profit. However, increasing the first period profit lowers the probability of an

injury determination and this allows the foreign firm to be less concerned with an affirmative injury determination, giving the foreign firm an opportunity to focus more on maximizing first period profit (and less on injury).

Since AD law distorts the foreign firm's price upward, the foreign firm can consider lowering its AD-distorted price. However, the foreign firm must weigh the costs (the marginal increase in the probability of a LTFV decision) against the benefits (higher first period profit) from lowering its price. As is shown in the appendix, as P_1 becomes sufficiently small the benefits outweigh the costs, leading the foreign firm to respond to an increase in the domestic firm's price by lowering its own price. In other words, AD law changes the nature of the competition – there is a region where the foreign firm regards the products as strategic substitutes instead of strategic complements ⟨Bulow, Geanakoplos, and Klemperer [1985]⟩.

This result implies that AD law creates a price floor for the foreign firm. The price floor reflects the fact the domestic firm cannot dupe the foreign firm into dumping. Suppose this were not the case. The domestic firm could set its first period price sufficiently low and induce a LTFV finding with certainty because of the fact that the foreign firm will respond with its own low price. However, if the imposition of duties is sufficiently painful for the foreign firm, it will not fall prey to such a strategy; pricing below P^*_{floor} inordinately increases the likelihood of a dumping duties, and the foreign firm will instead prefer to sacrifice first period profits in order to avoid duties.

This is a sensible result and merits at least two comments. First, price floors have well known collusive implications since they clearly alter what prices the foreign firm can threaten to charge ⟨Salop [1986]⟩. Therefore, the creation of a price floor is one example of the potentially deleterious effects of AD law. Second, there has been substantial debate over the U.S.'s use of the Trigger Price Mechanism (TPM) between 1978-1982. Part of this discussion has centered on the effect of the explicit price floor established by the TPM. Note, however, that this result suggests that there is always an implicit price floor created by AD law.

B. The Domestic Firm's Pricing Decision

We can now turn to the domestic firm's problem. We solve for its optimal

pricing behavior by differentiating (8) with respect to P_1. The first order condition is

$$\frac{\partial E\Pi(\cdot)}{\partial P_1}=\frac{\partial \Pi_1(\cdot)}{\partial P_1}+\delta\rho_1^I(\Pi_1(\cdot);\Pi^I)\frac{\partial \Pi_1(\cdot)}{\partial P_1}E\Delta(P_1^*)=0 \tag{11}$$

The first term in (11), $\partial\Pi_1(\cdot)/\partial P_1$, is the marginal change to first period profit while the second term is the marginal change to second period profit. The term $\delta E\Delta(P_1^*)$ represents the expected discounted gain to domestic firm's second period profit when dumping duties are imposed, while $\rho_1^I(\cdot)\partial\Pi_1(\cdot)/\partial P_1$, is the marginal increase in the probability that duties will be levied. Rearranging (11) yields

$$\frac{\partial E\Pi(\cdot)}{\partial P_1}=\frac{\partial \Pi_1(\cdot)}{\partial P_1}\Omega(\Pi_1(P_1^*,P_1);\Pi^1)=0, \tag{11'}$$

where $\Omega(\cdot)=[1+\delta\rho_1^I(\cdot)E\Delta(P_1^*)]$ can be interpreted as the net effect of a price change on first and second period profit. It may be greater than, less than, or equal to zero. If $\Omega(\cdot)>0$, the effect on first period profit dominates the effect on second period profit while if $\Omega(\cdot)<0$, the converse is true. If $\Omega(\cdot)=0$, the two effects exactly offset one another.

As before, let $\hat{P}_1\equiv\beta(P_1^*)$ denote the price the domestic firm would charge without AD law. Note that by definition $\partial\Pi_1(P_1^*,\hat{P}_1)/\partial P_1=0$ which implies that (11′) is satisfied at $\hat{P}_1$. Note also that (11′) could be satisfied for some alternative $P_1\neq\hat{P}_1$ as long as this alternative price implied $\Omega(\cdot)=0$.

The second order condition will be useful for determining what pricing strategy is optimal. Differentiating (11′) yields,

$$\frac{\partial^2\Pi_1(\cdot)}{\partial P_1^2}\Omega(\cdot)+\delta\left\{\frac{\partial\Pi_1(\cdot)}{\partial P_1}\right\}^2\left[\rho_{11}^I(\cdot)E\Delta(P_1^*)\right]. \tag{12}$$

The first term in the first expression is the domestic firm's no-AD law second order condition and is less than zero while $\Omega(\cdot)$ reflects the net effect on first and second period profit. The final expression reflects the change in the marginal likelihood of injury.

From the first order condition it is clear that either $\partial\Pi_1(\cdot)/\partial P_1=0$ or $\Omega(\cdot)=0$ (or both). As it turns out, by focusing on what happens at $\hat{P}_1$ we can

determine what the domestic firm's optimal response is.

Case (i) – First Period Effect Dominates: $\Omega(\cdot) > 0$ at $\hat{P}_1$

In this case, (12) evaluated at $\hat{P}_1$ simplifies to

$$\frac{\partial^2 \Pi_1(\cdot)}{\partial P_1^2}\Omega(\cdot) < 0,$$

implying a maximum at $\hat{P}_1$. Moreover, at any alternative $P_1 \neq \hat{P}_1$, $\Omega(\cdot) > 0$. Therefore, $\hat{P}_1$ is the unique maximum.

In this case the domestic firm maximizes profit by announcing price $\hat{P}_1$, just as it did without AD law. This result is easier to understand if one realizes that $\Omega(\cdot) > 0$ evaluated at $\hat{P}_1$ implies that the domestic firm's AD law-distorted objective, $E\Pi$, reaches its maximum at $\hat{P}_1$ and is globally concave. This case is depicted in Figure 3 by the curve labeled "$E\Pi$, case (i)". Not only is this function globally concave but it also lies everywhere above the domestic firm's expected two-period profit without AD law, Π.

Case (ii) – Second Period Effect Dominates: $\Omega(\cdot) < 0$ at $\hat{P}_1$

In this case, the second order condition implies a minimum at $\hat{P}_1$. In other words, the domestic firm's objective, $E\Pi$, is no longer globally concave. The threat of AD duties distorts the profit function because the potential gain from having AD duties levied is so great that the domestic firm seeks to increase the likelihood of an injury determination. Therefore, even though first period profits are maximized at $\hat{P}_1$ the firm does not choose this price since it minimizes the chance of an affirmative injury determination. This case is also depicted in Figure 3 by the curve labeled "$E\Pi$, case (ii)".

In this case, the domestic firm will deliberately lower its first period profit in order to increase the likelihood of having duties levied. It does this by choosing a target level for its first period profit. This target profit level will be chosen in order to balance the marginal loss to first period profit with the marginal gain to second period profit. Let Π_1^{target} denote the target profit level,

$$\Pi_1^{target} = \{\Pi \mid \Omega(\Pi; \Pi^I) = 0\}. \tag{13}$$

The strict concavity of $\Pi_1(\cdot)$ implies that the domestic firm can achieve its target profit by charging a price that is either lower or higher than $\hat{P}_1$. Let P_1^L and P_1^H denote these alternative prices where $P_1^L < \hat{P}_1 < P_1^H$. Formally, P_1^L and P_1^H satisfies

$$\{P_1 \mid \Omega(\Pi_1(P_1^*, P_1); \Pi^I) = 0\}.$$

At P_1^L and P_1^H the second order condition simplifies to

$$\delta\left\{\frac{\partial \Pi_1(\cdot)}{\partial P_1}\right\}^2 \left[\rho_{11}^I(\cdot) E\Delta(P_1^*)\right] < 0.$$

Thus, both P_1^H and P_1^L are local maximums.

Figure 3 depicts the target level of profit, Π_1^{target}, and the prices, P_1^L and P_1^H, that achieve the target. As discussed, the domestic firm's objective function has two maximums but both yield the identical level of profit, $E\Pi_d$. This must be the case since with either price the firm earns the same expected first period profit, Π_1^{target}, and therefore with either price the firm has the same probability of injury. Note however, that P_1^L and P_1^H need not be symmetric about P_1.

Case (iii) – Offsetting Effects: $\Omega(\cdot) = 0$ at $\hat{P}_1$

In this case $\hat{P}_1$ maximizes first period profit and also equalizes the effect on first and second period profit. This also implies that (12) is zero. However, the concavity of $\Pi_1(\cdot)$ implies that $\hat{P}_1$ uniquely solves (11) and maximizes $\Pi(\cdot)$. Therefore, in this case, $\hat{P}_1$ uniquely solves the domestic firm's maximization problem with AD law. The domestic firm's profit function in this case looks similar to the profit function in case (i) in Figure 3.

Summarizing the Domestic Firm's Best Response

Clearly, the domestic firm's best response will depend on whether the first or second period effect dominates. Moreover, the interpretation of the effect of the threat of an AD action varies considerably depending whether the first or second period effect dominates. If the first period effect dominates, the domestic firm does not alter its pricing strategy in order to gain a strategic legal advantage. If, on the other hand, the second period effect

dominates, the domestic firm will strategically lower its first period profit in the hope of later winning proving injury, and thus having duties levied against its foreign rival. In this case, we will say the domestic firm feigns injury (or experiences "spurious" injury) since it undertakes actions that decrease its profit.

It is straightforward to show that

Corollary 4: *The domestic firm is more likely to feign injury (i) the larger is the discount factor, (ii) the larger is the benefit from duties, and (iii) the larger is the probability of a LTFV determination.*

The foreign firm also critically influences whether the domestic firm alters its period-by-period profit maximizing behavior. In particular, consider when the foreign firm charges an extremely high first period price. In this case, the domestic firm need not change its behavior since not only does it earn close to monopoly profit in the first period, but it is also highly unlikely that there will be an affirmative LTFV determination. Alternatively, consider when the foreign firm charges a very low first period price. Once again, in this case the domestic firm will simply maximize its first period profit since the foreign firm's unduly low first period price implies that affirmative injury and LTFV determinations will almost certainly follow. Taken together, it is clear that the more extreme the foreign firm prices the more likely will case (i) be the relevant situation. On the other hand, consider when the foreign firm charges an "intermediate" first period price. In this case, whether the first or second period effect dominates depends crucially on the policy parameters. For instance, if the injury level of profit is inordinately high (or low) then there will be no incentive to deviate from the no-AD law behavior. Or, if the AD rules make it particularly difficult to show LTFV then there will once again be no incentive to deviate from the no-AD law behavior. In general, however, we can expect that there will be some range of prices which cause the domestic firm to change its pricing behavior.

In particular, domestic firm changes its behavior depends on the value of $\Omega(\cdot)$ along the no-AD law best response function. Letting P^*_{upper} and P^*_{lower} be defined by

$$\left\{P_1^* \mid 1+\delta\rho^I(\Pi_1(P_1^*,\beta(P_1^*);\Pi^I)E\Delta(P_1^*)=0,\ 0\le P_1^*\le \overline{P}_1^*\right\},$$

we have

Corollary 5: *If* $P^*_{lower} \le P^*_1 \le P^*_{upper}$ *the domestic firm will feign injury.*

We can now graph the domestic firm's best response correspondence. In Figure 2, the domestic firm's best response function without AD law, β, is depicted as a solid curve. For a given injury level, P^*_{upper} defines the foreign price above which the domestic firm will not choose to deviate from its no-AD law pricing behavior. Similarly, P^*_{lower} defines the foreign price below which the domestic firm will choose to not deviate from its no-AD law pricing behavior. That is, if $P^* \ge P^*_{upper}$ or $P^* \le P^*_{lower}$ then $\beta_d(P^*) = \beta(P^*)$. In other words, the first period effect dominates and case (i) is relevant. If, on the other hand, $P^*_{lower} < P^* < P^*_{upper}$ then the effect on second period profit dominates and domestic firm will choose to deviate from its no-AD law pricing strategy. For any price in this range, the domestic firm will be indifferent between two possible prices. For instance, as depicted in Figure 2 suppose that the foreign firm charges P^*_1. The domestic firm would charge $\hat{P}_1$ if maximizing first period profit were the optimal choice. However, at this price the domestic firm prefers to increase the likelihood of an injury determination, and thus, will be indifferent between charging P^L_1 or P^H_1. Therefore, the domestic firm's best response correspondence bifurcates in this range. Taking the entire price range into account, the domestic firm's best response correspondence, β_d, is depicted by the shaded line in Figure 2.

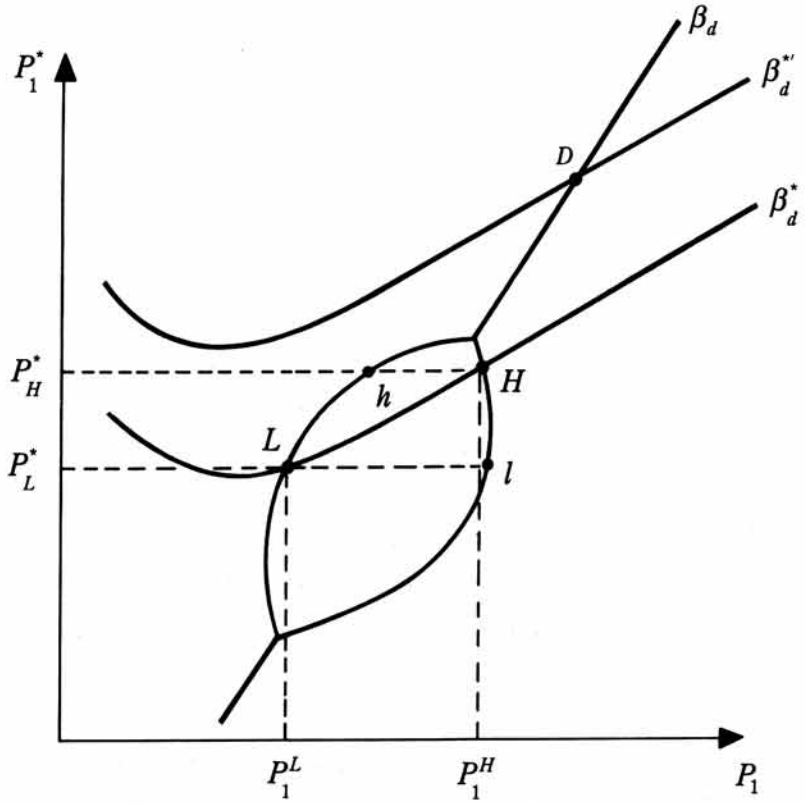
We can summarize this discussion as follows.

Proposition 2: *Suppose the foreign firm charges* P^*_1. Let $\hat{P}_1 = \beta(P^*_1)$ *denote the price the domestic firm would charge without AD law. The domestic firm's best response with AD law,* $\beta_d(P^*_1)$, *can be defined as*

$$\beta_d(P^*_1) = \begin{cases} \beta(P^*_1), & \text{if } [1+\delta\rho^I_1(\cdot)E\Delta(P^*_1)] \ge 0 \text{ evaluated at } \hat{P}_1, \\ \{P_1 \mid [1+\delta\rho^I_1(\cdot)E\Delta(P^*_1)] = 0\}, & \text{otherwise}. \end{cases}$$

Figure 4 depicts the equilibria with AD law. If the foreign firm's response is large, say $\beta^{*'}_d$, then the domestic firm will not find it in its best interest to deviate from its simple period-by-period profit maximizing behavior. In this case, the AD law equilibrium is depicted by the point D. In this equilibrium,

Figure 4
Bertrand-Nash Equilibrium – With AD Law



both firms charge higher first period prices than without AD law, but the price increases are driven entirely by the foreign firm's change in behavior. The domestic firm is only moving along its response curve, and therefore we should not interpret the change in the domestic price as a reflection of strategic manipulation of AD law.

If, on the other hand, the foreign firm's response is more moderate, say β_d^*, then the domestic firm may find it desirable to deviate from its period-by-period profit maximizing behavior. In this case, the domestic firm may change its first period behavior in order to induce an affirmative injury determination. For instance, for β_d^* there are two Nash equilibria depicted by the points L and H. When the foreign firm charges P_L^* the domestic firms is indifferent between two prices L and l. However, only L is a Nash equilibrium. At the L equilibrium, the domestic firm strategically attempts to lower first period profit by charging a lower first period price than it would charge

without AD law. Similarly, when the foreign firm charges P_H^* the domestic firm is indifferent between two prices h and H, with only H being a Nash equilibrium. At the H equilibrium, the domestic firm strategically attempts to lower first period profit by charging a *higher* first period price than it would charge without AD law.

Interestingly, relative to their no-AD law level of profits, both firms may prefer to compete with the threat of an AD action. In other worlds, the AD law equilibrium at point H may lie in the shaded region in Figure 1. Without AD law, both firms' profits suffer because of the incentive to undercut their rival's price. With AD law, the simple price-cutting motive is only one part of the firms' decision: the desire for high current period profit must be balanced with the goal of high profit next period. Interestingly, even though both firms' strategies suggest they are willing to sacrifice short-run profit for long-term benefits, both firms can earn higher first period profit. In this sense, AD law facilitates collusive behavior.

Note, however, that even if H is a facilitating practice equilibrium, we can not eliminate L as a Nash equilibrium since L might "risk dominate" H. Suppose for example that the price-high equilibrium (H) yields both firms greater profit than the price-low equilibrium (L). From a Pareto dominance perspective, H is the more reasonable equilibria. However, L might be the more reasonable of the two equilibria from a risk dominance perspective ⟨Harsanyi and Selten [1998]⟩. That is, both firms know there are two equilibria. The domestic firm knows that there is some chance (maybe quite small) that the foreign firm will play L and some chance it will play H. The cost (in terms of foregone profit) may quite large if the domestic firm mistakenly conjectures H will be played when in fact L is played. However, the cost may relatively small if the converse happens (*i.e.*, the domestic firm mistakenly conjectures L will be played when in fact H is played). Thus, according to Harsanyi and Selten's [1998] theory of risk dominance, L may be the more reasonable equilibria.

V. Extensions

In this section we demonstrate how the foreign firm's home market pricing decision can be incorporated into the model and show that the equilibria

do not qualitatively change from that discussed in section IV. To keep this extension as consistent as possible with the analysis in the previous sections, we will use primes to refer to the equations that change with the addition of the home market pricing decision.

We now imagine that the foreign firm sells its product in both its home market and in the domestic market. A prohibitive tariff gives the foreign firm monopoly control at home. Hence, the foreign firm charges P^*_{Ht} and earns $\Pi^H_t(P^*_{Ht})$ in its home market during period t. Thus, the foreign firm's objective function without AD law can be written as

$$\underset{\{P^*_{H1},P^*_1,P^*_{H2},P^*_2\}}{\text{Max}} \Pi^* = \Pi^H_1(P^*_{H1}) + \Pi^*_1(P^*_1, P_1) + \delta\{\Pi^H_2(P^*_{H2}) + \Pi^*_2(P^*_2, P_2)\}. \quad (2')$$

As before, we will assume that there is a unique equilibrium in the no-AD law case.

With home market sales, we might expect the LTFV calculation to be based upon a comparison of P^*_1 and P^*_{H1}. As discussed in section II there is significant amount of uncertainty surrounding the LTFV decision, and this is true even if the LTFV determination is based on a price comparison. We will say that the foreign firm has sold at LTFV if its price in the domestic market during the first period is less than the "observed" home market price (in domestic currency), $\hat{P}^*_{H1}$. In other words, the foreign firm is considered to have LTFV sales if

$$P^*_1 < \hat{P}^*_{H1} = P^*_{H1} + \varepsilon,$$

where ε captures the uncertainty surrounding the LTFV determination. We will assume that the distribution governing ε, $H(\cdot)$ is common knowledge and twice-continuously differentiable. We can write the probability of a LTFV determination as

$$\rho^L(P^*_1) = \int_{P^*_1 - P^*_{H1}}^{\infty} H'(x)\, dx.$$

It is convenient if we reformulate some definitions made earlier in section IV. Let $\Delta(\hat{P}^*_{H1})$ now be defined as

$$\Delta(\hat{P}^*_{H1}) \equiv \Pi_2(\hat{P}^*_{H1}, \beta(\hat{P}^*_{H1})) - \Pi_2(\tilde{P}^*_2, \tilde{P}_2), \quad (4')$$

and $E\Delta(P_1^*, P_{H1}^*)$ as

$$E\Delta(P_1^*, P_{H1}^*) \equiv \int_{P_1^* - P_{H1}^*}^{\infty} \Delta(P_{H1}^* + x)H'(x)\,dx - C. \tag{5'}$$

Let $\Delta^*(\hat{P}_{H1}^*)$ be redefined as

$$\Delta^*(\hat{P}_{H1}^*) \equiv \Pi_2^*(\hat{P}_{H1}^*, \beta(\hat{P}_{H1}^*)) - (\hat{P}_{H1}^* - P_1^*)Q_2^*(\hat{P}_{H1}^*, \beta(\hat{P}_{H1}^*)) - \Pi_2^*(\tilde{P}_2^*, \tilde{P}_2), \tag{6'}$$

And $E\Delta^*(P_1^*, P_{H1}^*)$ as

$$E\Delta^*(P_1^*, P_{H1}^*) \equiv \int_{P_1^* - P_{H1}^*}^{\infty} \Delta^*(P_{H1}^* + x)H'(x)\,dx - C^*. \tag{7'}$$

Given these definitions, we can now write the domestic firm's expected two-period profit as

$$E\Pi(P_1^*, P_1) = \Pi_1(P_1^*, P_1) + \delta\left\{\Pi_2(\tilde{P}_2^*, \tilde{P}_2) + \rho^I(\cdot)E\Delta^*(P_1^*, P_{H1}^*)\right\}, \tag{8'}$$

and the foreign firm's expected two-period profit as

$$E\Pi^*(P_{H1}^*, P_1^*, P_{H2}^*, P_2^*) = \Pi_1^H(P_{H1}^*) + \Pi_1^*(P_1^*, P_1) + \delta\Pi_2^H(P_{H2}^*) + \delta\left\{\Pi_2^*(\tilde{P}_2^*, \tilde{P}_2) + \rho^I(\cdot)E\Delta^*(P_1^*, P_{H1}^*)\right\} \tag{9'}$$

It is clear from (8') that the adding home market sales does not alter the domestic firm's incentives. However, the LTFV determination is now based on both P_1^* and P_{H1}^*, and the foreign firm will find it desirable to alter both prices. In particular, the foreign firm's first order conditions can be written as

$$\frac{\partial E\Pi^*(\cdot)}{\partial P_1^*} = \frac{\partial \Pi_1^*(\cdot)}{\partial P_1^*} + \delta\left\{\rho_1^I(\cdot)\frac{\partial \Pi_1(\cdot)}{\partial P_1^*}E\Delta^*(P_1^*, P_{H1}^*) - \rho^I(\cdot)\Delta^*(P_1^*)H'(P_1^* - P_{H1}^*)\right\} = 0 \tag{14}$$

$$\frac{\partial E\Pi^*(\cdot)}{\partial P_{H1}^*} = \frac{\partial \Pi_1^H(\cdot)}{\partial P_{H1}^*} + \delta\rho^1(\cdot)\left\{\Delta^*(P_1^*)H'(P_1^* - P_{H1}^*) + \int_{P_1^* - P_{H1}^*}^{\infty} \frac{\partial \Delta^*(P_{H1}^* + x)}{\partial P_{H1}^*}H'(x)\,dx\right\} = 0 \tag{15}$$

Equation (14) has the exactly the same form and interpretation as (10); both imply that the foreign firm will raise its price to the domestic market. Equation (15) reflects the effect on profits of a marginal change in P^*_{H1}. Without AD law, the foreign firm simply maximizes home market profits by setting the first term, $\partial\Pi^H_1(\cdot)/\partial P^*_{H1}$ equal to zero. With AD law the foreign firm must balance its desire to maximize home market profit with the incentive to decrease the likelihood of having duties levied. The curly bracketed expression in (15) is negative which implies that the foreign firm will lower the price it charges in its home market.

These is a sensible result. When the LTFV determination is based on the difference $P^*_1 - \hat{P}^*_{H1}$, the foreign firm will in general find it optimal to change both prices, raising P^*_1 and lowering P^*_{H1}. It is clear, then, that for any given P_1, the foreign firm will charge a higher price in the domestic market with AD law than it does without AD law, and thus qualitatively, the equilibria in the domestic market with AD law will be the same as the equilibria discussed in section IV.

This discussion leads us to the following proposition.

Proposition 3: *In a model where the foreign firm has home market sales, AD law induces the foreign firm to (i) announce a higher first period price in the domestic market, for any given P_1, and (ii) announce a lower first period price in the home market.*

VI. Concluding Comments

This paper has presented a model of the effect of domestic AD law on the noncooperative behavior of foreign and domestic rivals. In contrast with most of the previous literature, we have focused on the welfare effects of AD law prior to the filing of an AD action. We have shown that AD law has significant effects even if duties are never levied. First, the foreign firm responds to the law by raising its first period price in order to decrease the chance of LTFV determination and to increase the domestic firm's profit, thereby decreasing the likelihood of an injury determination. This is the intended effect of the law. Second, AD law may distort the domestic firm's pricing decision. In many circumstances, AD will not distort the domestic

firm's strategy, *i.e.*, case (i). In this case, AD raises the domestic firm's price only because it finds it optimal to respond to its rival's higher price by raising its own price. In other words, there is no strategic manipulation of the law.

In other circumstances, however, the domestic firm can have an important marginal impact on the injury determination. In this case, the domestic firm will strategically lower its profits in order to increase the likelihood of an affirmative decision: smaller profits today means a greater chance of an affirmative injury determination and larger profits tomorrow. The domestic firm deliberately injures itself in order to reap the benefits of protection tomorrow. This strategic response involves a distortion to domestic prices. The distortion can either raise or lower prices.

There are several comments to make regarding the robustness of the results. First, unlike many game theoretic models, the choice of strategic variable does not plays an overly important role in the nature of the equilibrium. Although the equilibria will differ under Cournot competition, the two key insights of the model – that the domestic firm has incentives to injury itself and that AD law can lead to collusive outcomes – would be robust to such a change. Moreover, if the injury determination continues to be a function of domestic profits, there will continue to be a region where the domestic firm chooses not to deviate from its no-AD law quantity strategies. And, when it does deviate, the distortion can again involve either increasing or decreasing its quantity.

Second, in practice other factors, such as employment, shipments, investment, *etc.* are often incorporated into the injury decision, which might lead us to broaden how we model the injury criterion.[13] In general, changing the injury criterion will not only alter the domestic firm's response, but also change how and when the domestic firm chooses to respond. For instance, if the domestic firm's investment is a part of the injury criterion, then the domestic firm will clearly choose to decrease its current period investment. Such strategic under-investment can have drastic welfare consequences, especially if protection is not granted.[14] Shipments are also often used to

13. It is not obvious, however, that the weight attached to these criteria is done in any consistent way.

determine the status of the domestic industry. Typically, one would expect a decrease in shipments to reflect injury. This suggests that the "price low" strategy might be dominated by the "price high" strategy, and thus that the bifurcation result to be eliminated. However, if the LTFV determination is based on the "sales below cost" definition, then the domestic firm may prefer the "price low" strategy. Without more extensive model development, it seems possible that either strategy could dominate.

All in all, the results of the model appear quite intuitive and have important policy implications. Due largely to the historical preeminence of tariffs and quotas, analysts have tended to focus only on the effects of trade policy once the duty/restriction was imposed. Given the emergence of administered protection, it especially important for trade theorists to examine not only the administered outcome but also the incentive to influence the outcome. This paper suggests, for instance, that since government's use standard economic criteria (*e.g.*, profits, employment, capital utilization, *etc.*) to assess injury, they should try to separate the avoidable injury (due to suboptimal firm decisions) from injury due to foreign competition.

Appendix
Proof of Corollaries 2 and 3

The slope of the foreign firm's best response function is

$$\frac{d\beta_d^*}{dP_1} \equiv -\frac{-\partial^2 E\Pi^* / \partial P_1^* \partial P_1}{\partial^2 E\Pi^* / \partial P_1^{*2}}.$$

The denominator is merely the second order condition and is less than zero. The numerator can be rewritten as

$$\frac{-\partial^2 E\Pi^*}{\partial P_1^* \partial P_1} = \frac{\partial^2 \Pi_1^*(\cdot)}{\partial P_1^* \partial P_1} + \delta\left\{\frac{\partial \Pi_1(\cdot)}{\partial P_1}\left[\rho_{11}^I(\cdot)\frac{\partial \Pi_1(\cdot)}{\partial P_1^*}E\Delta^*(P_1^*) - \rho_1^I(\cdot)\Delta^*(P_1^*)F'(P_1^*)\right]\right\}$$

$$+\delta\left\{\rho_1^I(\cdot)\frac{\partial^2 \Pi_1(\cdot)}{\partial P_1^* \partial P_1}E\Delta^*(P_1^*)\right\}$$

14. Krugman [1982] discusses the important dynamic effect current investment strategies play in long-run profitability.

The first and last terms are positive. However, note that the square bracketed expression is negative; for $P_1 < \beta^*$ the curly bracketed expression is negative since $\partial \Pi_1 / \partial P_1 > 0$. The strict concavity of Π_1 implies that for P_1 sufficiently small, $\partial^2 E\Pi^* / \partial P_1^* \partial P_1$ will become negative. The continuity of all functions implies corollary 3.

References

Bhagwati, Jagdish [1988], *Protectionism,* Cambridge: The MIT Press.

Boltuck, Richard [1991], "Assessing the Effects on the Domestic Industry of Price Dumping," in P.K.M. Tharakan (ed.), *Policy Implications of Antidumping Measures,* Amsterdam: North-Holland.

Boltuck, Richard and Robert E. Litan [1991], *Down in the Dumps,* Washington, D.C.: The Brookings Institution.

Bulow, Jeremy I., John D. Geanakoplos, and Paul D. Klemperer [1985], "Multimarket Oligopoly: Strategic Substitutes and Complements," *Journal of Political Economy* 93; 488-511.

Finger, J.M. [1981], "The Industry-Country Incidence of LFV Cases in U.S. Import Trade," *Quarterly Review of Economics and Business*; 260-279.

Finger, J.M., H. Keith Hall, and Douglas R. Nelson [1982], "The Political Economy of Administered Protection," *American Economic Review* 72; 452-466.

Fischer, Ronald D. [1992], "Endogenous Probability of Protection and Firm Behavior," *Journal of International Economics* 32; 149-163.

Friedman, James [1983], *Oligopoly Theory,* Cambridge: Cambridge University Press.

Hansen, Wendy L. and Thomas J. Prusa [1993], "The Road Most Traveled: The Rise of Title VII Protection," unpublished manuscript, S.U.N.Y. at Stony Brook.

Harsanyi, John C. and Reinhard Selten [1988], A *General Theory of Equilibrium Selection in Games,* Cambridge: The MIT Press.

Hartigan, James C. [1993a], "Dumping and Signaling," forthcoming *Journal of Economic Behavior and Organization.*

Hartigan, James C. [1993b], "Collusive Aspects of Cost Revelation through Antidumping Complaints," unpublished manuscript, University of

Oklahoma.

Herander, Mark G. and J. Brad Schwartz [1984], "An Empirical Test of the Impact of the Threat of U.S. Trade Policy: The Case of Antidumping Duties," *Southern Economic Journal* 51; 59-79.

Hoekman, Bernard M. and Michael, P. Leidy [1989], "Dumping, Antidumping, and Emergency Protection," *Journal of World Trade Law* 23; 27-44.

Jackson, John H. and Edwin A. Vermulst [1989], *Antidumping Law and Practice*, Ann Arbor: University of Michigan Press.

Krugman, Paul [1982], "Import Competition as Export Promotion: International Competition in the Presence of Oligopoly and Economies of Scale," in H. Kierzkowski (ed.), *Monopolistic Competition and International Trade*, Oxford: Clarendon Press.

Leidy, Michael P. [1993], "Quid Pro Quo Restraint and Spurious Injury: Subsidies and the Prospect of CVDs," in Alan Deardorff and Robert Stern (eds.), *Analytical and Negotiating Issues in the Global Trading System*, Ann Arbor: University of Michigan.

Leidy, Michael P. and Bernard M. Hoekman [1990], "Production Effects of Price- and Cost-based Antidumping Laws under Flexible Exchange Rates", *Canadian Journal of Economics* 23; 873-895.

Prusa, Thomas J. [1993], "Why are so Many Antidumping Petitions Withdrawn?," *Journal of International Economics* 33; 1-20.

Salop, S.C. [1986], "Practices that (Credibly) Facilitate Oligopoly Coordination," in J. Stiglitz and G.F. Matthewson (eds.), *New Developments in the Analysis of Market Structure*, Cambridge: The MIT Press.

Staiger, Robert W. and Frank A. Wolak [1991], "Strategic Use of Antidumping Lwa to Enforce Tacit International Collusion," unpublished manuscript, Stanford University.

Tharakan, P.K.M., (ed.) [1991], *Policy Implications of Antidumping Measures*, Amsterdam: North-Holland.

Webb, Michael A. [1992], "The Ambiguous Consequences of Antidumping Law," *Economic Inquiry* 30; 437-448.