

Hartigan, James C.; Vandenbussche, Hylke

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Why does the WTO have an Antidumping Agreement?

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James C. Hartigan and Hylke Vandenbussche



Katholieke Universiteit Leuven

LICOS Centre for Institutions and Economic Performance
Huis De Dorlodot
Deberiotstraat 34 – mailbox 3511
B-3000 Leuven
BELGIUM

TEL: +32-(0)16 32 65 98

FAX: +32-(0)16 32 65 99

<http://www.econ.kuleuven.be/licos>

WHY DOES THE WTO HAVE AN ANTIDUMPING AGREEMENT?

James C. Hartigan

Department of Economics

University of Oklahoma

Norman, Oklahoma

U. S. A. 73019-2103

Hylke Vandenbussche

Department of Economics and CORE

Catholic University of Louvain-la-Neuve

1348 Louvain-la-Neuve

Belgium

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Abstract

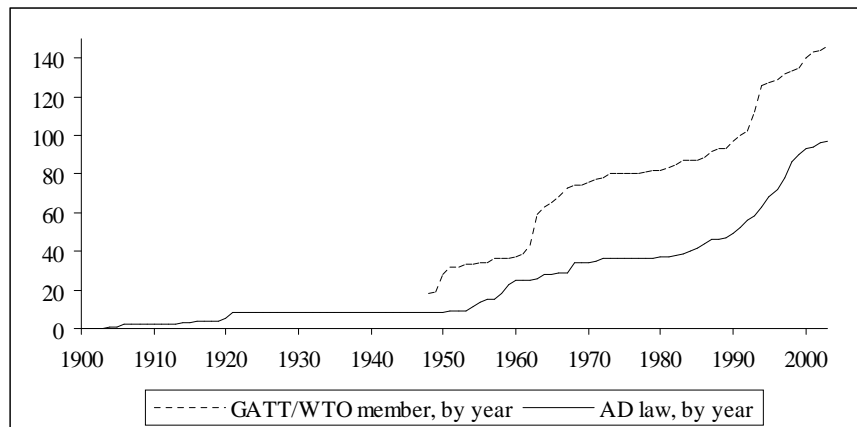
This paper develops a model that offers a plausible interpretation for the empirical observation of diffusion of antidumping (AD) laws amongst

WTO members. Contrary to the regnant belief that this proliferation is driven mainly by retaliatory motives, our model shows that adoption and use of AD laws involve a cooperative act amongst WTO members in an infinite horizon game. The diffusion of AD laws need not result in a Prisoner's dilemma. Instead we show that the AD agreement of the WTO can serve as a risk-sharing vehicle amongst WTO members in response to adverse shocks incurred by domestic producers.

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1 Introduction

In recent years, membership of the World Trade Organization (WTO) has expanded substantially, as have the number of signatories with antidumping (AD) laws. This is illustrated in Figure 1. While in 1980 only 49 countries had an (AD) law, this number doubled by 2003 with more than 103 countries having such a law (Vandenbussche and Zanardi, 2008b). This paper gives a plausible interpretation as to why WTO signatories want to adopt AD laws and the institutions to implement them. Furthermore it offers an explanation as to why the WTO has a mandatory AD Agreement (ADA), which was not the case under



the General Agreements on Tariffs and Trade (GATT)¹. Participating signatories are obliged to subscribe to the ADA, requiring adherence to its standards and practices upon adoption of an AD law². The model we present in this paper demonstrates that AD law adoption is a dominant strategy of WTO members. This explains the WTO's desire to impose discipline on practices and procedures by making the ADA mandatory.

The emphasis of the AD agreement is upon imports that are unfairly traded (dumped) and that materially injure the domestic industry³. Dumping of goods

¹The GATT did (could) not make acceptance of its AD Code mandatory. Dumping did not begin to get the attention of its contracting parties (CPs) until the 1960s. As authors such as Jackson (1997) have noted, it was virtually impossible to amend the GATT, with the result being a smorgasbord of side agreements in which participation was voluntary. Partially as a result of this, the CPs recognized the need for a new organization governing world trade with required acceptance of all agreements..

²A WTO signatory may choose to pass national AD legislation, or not. However, each signatory must accept the ADA which disciplines how governments "can or cannot react to dumping" as mandated under the Uruguay Round (www.wto.org). Accepting the agreement and passing domestic AD legislation are distinct actions, as is the administration of an AD law.

³Art 3 of the ADA stipulates that the determination of material injury to the home industry be based upon an "objective examination" of "the volume of dumped imports". Although Art 3 mentions export performance as being among "factors which may be deemed relevant",

refers to a practice of international price-discrimination with lower prices and markups abroad in comparison with the country of origin (art. 3 ADA). A reduction in domestic sales coinciding with an increase in imports is generally regarded as sufficient evidence of injury to the domestic industry. Faced with a (perhaps sudden) increase in the volume of dumped imports, an importing country can impose WTO consistent AD duties against one or several importers to protect its domestic industry⁴. The model developed in this paper shows that an adverse cost shock in a single country coincides with an increase in the volume of dumped imports and a reduction in the production of its domestic industry, thereby satisfying the sufficiency criteria for AD protection to be applied^{5, 6}.

We use a multi-country model with infinite horizon and transport costs in which all firms sell domestically and export to all other countries. Taking an AD action by any country does not result in a Prisonner's dilemma with retaliation

a reading of U.S. International Trade Commission cases suggests that they are used primarily to assess the competitiveness of domestic producers. See www.usitc.gov.

⁴In our model increased imports are the consequence of the adverse shock, not the cause of injury. As shown by Durling and McCullough (2005); Grossman and Wauters (2008) and others, the causality requirement between dumping and injury in AD cases is very loosely interpreted. This is despite an explicit requirement that injury which reasonably is attributable to another cause cannot be attributed to imports of subject merchandise. Shin (1998), after scrutiny of several hundreds of AD cases, arrives at the conclusion that more than 90% of AD cases are not about unfair trade. Rather, they are about using industrial policy to foster the interests of the domestic industry

⁵Such a shock may be sectoral and domestic, sectoral and global, aggregate and domestic, or aggregate and global in practice. For simplicity of presentation, we consider a single industry in each country and suppose that shocks among firms in an industry are independently and identically distributed.

⁶In principle the more appropriate instrument to use would be a safeguard (SG). However, there are several reasons to believe that firms prefer to file for AD protection. First, a SG imposes a higher injury standard (serious vs. material) making protection harder to obtain. Second, under WTO rules, a SG can be imposed for 4 years with the possibility of a 4 year renewal, while AD duties have a 5 year sunset rule with a fairly high chance to obtain multiple 5 year renewals (Liebman, 2004; Moore, 2006). Third, AD duties, particularly those calculated under constructed value, tend to be much higher than SG duties (Boltuck and Litan, 1991; Blonigen 2006) In fact, governments also may prefer AD protection since unlike SG they do not allow adversely affected exporters to request compensation under "nullification and impairment of expected benefits" (www.jurisint.org).

by the other countries. Rather, it results in a stable and cooperative equilibrium. Our model also shows that the discretionary rules surrounding the causality requirement serve a purpose i.e. they serve to uphold a cooperative and stable trade policy equilibrium.

We define “cooperation” as WTO consistent behavior i.e. free trade or the taking of an AD action that complies with the ADA. While an AD action is clearly less cooperative than free trade, it is considered cooperative when it is in compliance with the ADA agreement. Adherence to the ADA is more cooperative than undisciplined protectionism. All other behavior by member countries is considered to be “defection” and a violation of WTO rules. Examples include the use of AD duties in the absence of an adverse shock that increases the output of the domestic industry. Documented instances of defection from the ADA include the Byrd Amendment and the use of zeroing in the calculation of AD duties, in both of which the U.S. was the respondent in disputes under the ADA⁷.

While WTO has little enforcement power, punishment after defection could entail a future unwillingness to cooperate on trade related issues⁸. For simplicity we will assume that the loss from defection is sufficiently large to sustain cooperation under the ADA agreement once countries adopt an AD law. A primary contribution of the paper is to show that for each WTO member, the

⁷Although history suggests that occasional disputes do arise, Tarullo (2002) and Bown (2005) discuss why AD disputes filed with the Dispute Settlement Body (DSB) are relatively uncommon.

⁸Unwillingness to engage in future trade liberalization or to enhance intellectual property enforcement, or an unwillingness to augment the WTO to address labor rights or environmental rights could be punishment strategies pursued by countries against a violator of the ADA agreement.

adoption of AD laws is a dominant strategy. Compliance with the ADA is feasible without invoking "punitive actions" in which members introduce welfare reducing noncooperative behavior for some time. Thus our model rationalizes the existence of the ADA agreement and offers a plausible explanation for some of its features.

Within the economics literature, the application of conditional protection agreements (the ADA, the agreement on safeguards (ASG), and the agreement on subsidies and countervailing measures (ASCVM)) has been explained through either of two interpretations. One is retaliation which may arise because the WTO (and its predecessor GATT) is not a strong supra-national authority⁹. Hence members police deviations from commitment to trade liberalization through punishment inflicted through retaliatory action at the industry and/or country level (Martin and Vergote (2008)). The other explanation is that conditional protection facilitates temporary defection from free trade when the domestic pressures to restrict trade become excessive (Baldwin and Staiger (1990) and (Ethier, 2002)).

The primary result of this paper is that universal acceptance of AD institutions by WTO members serves as a risk sharing vehicle. Suppose, for example, that the WTO consists of two members, where an industry in one incurs an ad-

⁹For example Lindsey and Ikenson (2001) argue that patterns of filings are consistent with retaliatory use. Prusa & Skeath (2005) and Feinberg and Reynolds (2006) also confirm that new users of AD predominantly use it for retaliation. Retaliation is also identified as a primary motive for AD law adoption by Vandenbussche and Zanardi (2008a). Proliferation and retaliation have been addressed in the legal literature by Maur (1998). Empirically, filing patterns that are consistent with retaliation are also consistent with contemporaneous or proximate realizations (correlated or uncorrelated) of adverse shocks in multiple exporting countries.

verse shock and the corresponding industry in the other does not. The country adversely affected will want to protect its industry to preserve home output. Its trading partner will be affected adversely through loss of exports, but its constituent industry will not lose home output, since markets in the reciprocal dumping model are segmented and marginal costs are assumed to be constant. As more countries participate in the absorption (through reduced exports) of an adverse shock in the home market of any member, the cost of absorption becomes smaller. To highlight the benefits of risk sharing, we initially assume a two country WTO and then expand its membership to three countries.

Hence, according to a reasonable interpretation of the ADA, the trade partner does not have the right to retaliate with AD measures since production by its constituent firm for the home market is unaffected¹⁰. However, as a WTO member, it has the right to protect its constituent industry when that industry incurs an adverse shock in the future. Members thus share the risk of absorbing adverse shocks, which they both face with uncertain timing. With an increase in membership, each exporter's share in absorbing the shock in a given member declines, thus making participation in the ADA attractive¹¹.

There is some empirical evidence to suggest that our theoretical explanation is a plausible one. For instance, Knetter and Prusa (2006) have shown that macroeconomic factors (shocks) related to the domestic market play an

¹⁰The formal right of retaliation is granted only by the DSB. However, the retaliatory explanation for AD diffusion suggests that it is invoked informally.

¹¹If adverse shocks are correlated at the aggregate level across members, then risk sharing is undermined. However, if the shocks are correlated at the industry level of the signatories, then risk sharing is enhanced to the extent that multiple import competing industries exist.

important role in antidumping filings, despite the focus of the ADA upon unfair foreign pricing.

To provide an explanation for the proliferation of AD laws and their usage, we posit a game of infinite horizon in two stages, and utilize subgame perfection. In the first stage of the initial period, each WTO member simultaneously decides whether or not to subscribe to the ADA, and each member decides whether or not to pass national legislation introducing an AD law and establishing the institutions to implement the law. Signatories do not know which of them will invoke an AD action at the time the agreement is negotiated. All that is known at this time is that, in the subsequent stage of the first period and in later periods, each country is subject to the same probability of incurring an adverse shock in each period. Each country contains a constituent firm that produces a homogeneous commodity. The firms play a simultaneous move game of strategic substitutes in each country in every period. Transportation costs are incurred for exporting. Thus the home firm will have a larger share of the market in which it is domiciled than it will have for either of its export markets¹²

In the second stage of the initial period (and the only stage of each sub-

¹²Thus we have a framework that is analogous to the reciprocal (two country) dumping model of Brander and Krugman (1983) and the universal dumping (multiple country) model of Murray and Kurdaliev (1999). The difference between price and marginal cost in the firm's home market exceeds the difference between price and the sum of marginal and shipping costs for export. An appealing feature of these models is that all firms sell in all markets, so it is a natural framework for a comparison of our approach with that of retaliation. Another attractive aspect is that unfair pricing, as defined by the ADA, is present in every period. This is consistent with the high frequency of affirmative unfair pricing rulings by domestic AD authorities. For example in the U.S., the International Trade Administration of the Department of Commerce, under whose auspices the unfair pricing decision is vested, decides in the affirmative about 95 percent of the time. (See Boltuck and Litan (1991) and Blonigen (2006)). Thus we can focus upon the adverse shock.

sequent period), the firms draw a marginal cost of production for that period. The firms' drawing of their marginal costs of production for each period are independently and identically distributed¹³. These costs can be high or low. High costs are an adverse shock that will induce an AD petition resulting in an affirmative verdict. Persistence of shocks is not considered.

The initial strategic action of this stage entails the decision as to whether or not to file an AD petition¹⁴. The ADA requires that two existence conditions be met for an affirmative verdict to be rendered. One is the existence of unfair pricing. As noted above, the reciprocal/ universal dumping model assures that discriminatory pricing in favor of the export market will always exist¹⁵. The second existence condition is that of material injury. Since there are two possible realizations of marginal costs, we define material injury as a high realization of marginal costs¹⁶. With an affirmative verdict, AD duties are imposed that permit the petitioning firm to realize the home market output that would occur if there had not been injury, i.e. equal to that which would arise if all firms had

¹³The independence assumption draws a sharper contrast with the explaining of AD diffusion through retaliation. If advanced economies protect high cost industries by AD actions, and these high costs are a result of correlated adverse shocks, there is little distinction that can be drawn between these explanations through observation.

¹⁴It is at variance with observation to allow for a petition prior to solution for the equilibrium in each market for that period. As noted above, the home firm's output, price, and profits, would be analyzed in the injury determination. Constructing a model to account for this would mandate an intertemporal linkage in the market equilibrium, petition, and duty imposition decisions. That is, a petition in period t would be based upon the period $t - 1$ equilibrium for the material injury investigation. In the petition period t , the firm would have drawn a new marginal cost realization. It may have incurred injury in $t - 1$, but not need protection in t . Our approach allows us to address diffusion of AD utilization while avoiding these complexities.

¹⁵The other recognized basis for unfair pricing, that of selling at a price below average total cost, cannot occur in a universal dumping model.

¹⁶Note that by this definition of material injury, it is possible for all three firms to be materially injured simultaneously through the drawing of high marginal costs. Hence we would expect that each firm would file against both of its rivals.

low costs. After the decision as to whether or not to file a petition, firms set their optimal output for each of the three markets in which they compete. Firms are completely informed about marginal cost levels. The selection of outputs permits the calculation of prices and profits for each market.

Through this simple framework, we derive an explanation for the diffusion of AD laws. In particular, we demonstrate that all countries will enact AD laws and devise the institutions to implement them when they form a WTO¹⁷. In the anticipation of the realization of adverse shocks in the future, each member has an incentive to adopt. The focus upon a single homogeneous industry with non-autoregressive adverse shocks is not entirely innocuous. It may obscure patterns of filing that are based upon heterogeneity in costs or product attributes. For example, advanced economies tend to utilize AD law to protect persistently high cost industries¹⁸. Our contribution is to invoke homogeneity to disclose that AD actions may serve as a risk sharing vehicle for the incurring of a random adverse shock. That is, while not condoning the proliferation of global AD actions, we portray the ADA in a more favorable manner. We also provide a conceptual explanation for AD diffusion, and a justification for inclusion of the ADA in the Uruguay Round that established the WTO.

¹⁷This result requires explanation, as it is at variance with the fact that not all WTO members have adopted AD laws and implementing institutions. Possible reasons for non adoption or delayed adoption include a paucity of legal expertise in less developed countries, and the existence of technical barriers to trade (TBT) that offer insulation from adverse shocks. What's more, enhanced modeling sophistication that specified continuous cost distributions with non intersecting supports or intersecting supports of small measure may generate heterogeneity of AD adoption. For instance Vandenbussche and Zanardi (2008b) show that the primary countries not having AD laws today are poor African states.

¹⁸Konings and Vandenbussche (2008) show that industries filing AD petitions have lower initial productivity (higher marginal costs) than others.

2 A Model for a Two Country WTO

We begin by defining $\Omega_i, i = 2, 3$, as the set of WTO members. Let the membership in this section be given by the pair $\Omega_2 = \{X, Y\}$. Each country $I, J = X, Y$ and $I \neq J$ has a constituent firm, the period t output of which comprises the set $\omega_{it} = \{i_t^I, i_t^J\} \forall i = x, y$. Countries and firms are denoted by corresponding upper and lower case letters. Thus i_t^I are home market sales and i_t^J are exports for firm i in period t . The goods are homogeneous and all production costs are variable. Demand in each country is identical in every period, and is given by the linear function

$$p_t^I = a - b(x_t^I + y_t^I), \quad I = X, Y \quad (1)$$

where $a, b \in \mathbb{R}^+$. The density function for the constant per unit costs $f(c)$ has discrete support at \bar{c} and \underline{c} , where $\bar{c} > \underline{c}$ in \mathbb{R}^+ . Drawings of marginal costs are independently and identically distributed among firms and over time. The profit function for each firm for sales in its domicile in period t is given by

$$\pi_{it}^I = (p_t^I - c_i)i_t^I, \quad i = x, y \quad (2)$$

For a firm's export market, it incurs a shipping cost of s per unit, where $s \in \mathbb{R}^+$. This implies that markets are segmented, which permits focus upon a single country with generalization to the other(s). The profit function for exports is denoted by

$$\pi_{it}^J = (p_t^J - c_i - s)i_t^J, \quad (3)$$

Differentiating (2) and (3) with respect to i where $I, J = X, Y$ and $I \neq J$ permits the generation of a pair of period t best response functions¹⁹. Assuming an interior solution and solving these simultaneously yields the the set of optimal outputs for country I as

$$i_t^I = (a - 2c_i + c_j + s)/3b \quad (4)$$

$$j_t^I = (a - 2c_j + c_i - 2s)/3b \quad (5)$$

From this point in the exposition, we will suppress the subscript t , and will define market share of output i in country J as

$$m_i^J = i/(i + j), \quad i, j = x, y$$

$$i \neq j, \quad I, J = X, Y, \quad I \neq J \quad (6)$$

It is immediately apparent that $m_i^I > m_i^J$ for $c_i = c_j$. Analogous solutions can be found for country J .

Although investigating authorities can take into account a variety of indica-

¹⁹ AD petitions primarily occur in industries that produce homogeneous goods, such as steel, other metals, and chemicals. Thus we portray Nash-Cournot competition. We believe that our results would be robust to the specification of Nash-Bertrand competition, which would entail greater algebraic complexity since differentiated products would have to be introduced.

tors of performance in the material injury decision, we will utilize production for the home market for convenience²⁰. Our definition of material injury is the incurring of an adverse shock of production cost. That is, $c_i = \bar{c}$ satisfies our criterion for the existence of material injury²¹. Normal output is considered to be at the low cost realization $c_i = \underline{c}$.

2.1 Stage Two: The Market Equilibrium

The strategic decision regarding output for each market occurs in every period. If there are no AD petitions filed, the market equilibrium is as depicted by (4) and (5) for outputs in country I , with substitutions into (1) to determine price and into (2) or (3) to determine profits. The equilibrium for J is generated analogously.

If there is an AD petition, duties are imposed to increase the costs of serving the market of the signatory imposing them. So as to be consistent with our model of strategic substitutes, we will increase the costs of serving the market that is protected with an AD duty by $\bar{\gamma}$ when the exporting firm has high costs (\bar{c}), and $\underline{\gamma}$ when the exporting firm has low costs (\underline{c}). Hence $\underline{\gamma} > \bar{\gamma} > 1 \subset \mathbb{R}^+$. Suppose that country I imposes an AD duty on the firm in J . The market equilibrium in I will be given by

²⁰Other permitted criteria include market share, sales, profits, capacity utilization, employment, imports, subject imports, production costs, R&D expenditures, wages, return on investments, and rates of change thereof. See www.jurisint.org.

²¹Our focus on the AD law is as a means of addressing an unanticipated adverse shock to a constituent firm. We could have invoked a demand shock in lieu of the cost shock. However, Hartigan (2005) has used demand shocks to demonstrate that material injury can arise endogenously in the context of reciprocal dumping and technical advancements to demonstrate that an industry may become a perpetual technical laggard in the absence of protection. Thus we prefer to use cost shocks.

$$i_t^I = (a - 2c_i + \gamma c_j + s)/3b \quad (7)$$

$$j_t^I = (a - 2\gamma c_j + c_i - 2s)/3b \quad (8)$$

The market equilibrium outputs in I in the absence of any adverse shocks at home or abroad requires substitution of \underline{c} for c_i and c_j in (4) and (5). This yields an output of $(a - \underline{c} + s)/3b$ for the home firm, and exports of $(a - \underline{c} - 2s)/3b$ for the foreign firm to the home market. In the presence of an adverse shock at home but not abroad, we substitute $\underline{\gamma c}$ for c_j and \bar{c} for c_i in (7), and set the resulting expression equal to the "normal" output level given by $(a - \underline{c} + s)/3b$ yielding

$$\underline{\gamma} = (2\bar{c} - \underline{c})/\underline{c} \quad (9)$$

This is the factor by which firm j 's production cost for exporting to country I must be increased, in order to restore firm i 's output for its home market to the level at which it would be without shocks in either member, after realization of an adverse shock in I but not in J ²². Firm i 's gain from protection by the AD duty is equal to $2(\bar{c} - \underline{c})/3b$ ²³. Firm j 's best response in terms of output to $(a - \underline{c} + s)/3b$ is $j^I = (a - \underline{c} - 2s)/3b$ ²⁴. That is, firm j exports the same volume

²²Note that γ would be lower if the firm in J also incurred a shock in that period.

²³Compare the outputs for firm i in (4) for cost realizations $c_i = \bar{c}$ and $c_i = \underline{c}$.

²⁴The home firm is transformed into a quasi (von Stackelberg) leader by the home AD law and complete information as to the injury standard. We use quasi because we have substituted an actual output level of the home firm into the foreign firm's best response function. The traditional sequential move game substitutes the best response function of the follower into the leader's objective function. Vandenbussche, Veugelers, and Konings (2001) have disclosed that a price undertaking as a resolution to an AD dispute creates strategic leadership for the

to I as it would in the absence of the adverse shock. Thus firm j incurs a loss in exports of $(\bar{c} - \underline{c})/3b$ as a result of being prevented by I 's AD duty from taking advantage of the adverse shock in I . Given that our injury standard is defined in terms of output, assessment of the decision as to whether or not to introduce an AD law is informed by a comparison of the gain in home market output when the home firm realizes an adverse shock with the loss in home exports when the foreign firm realizes an adverse shock in a future period and assesses an AD duty²⁵. The loss in exports is the difference in exports with and without the AD laws when an adverse shock affects firm i but not firm j . For firms to expect to benefit under AD laws that address adverse shocks, we subtract $(\bar{c} - \underline{c})/3b$ from $2(\bar{c} - \underline{c})/3b$. This clearly is positive. The home firm gains more from protection of its production for its home market than it loses from the foreign government's protection of its rival's home market.

2.2 Stage Two: The Petition, Investigation, and Verdict

This strategic decision may take place in every period. It begins with a drawing of marginal cost. As was noted above, the reciprocal dumping model assures that the existence of unfair pricing always holds. Hence the material injury decision is the gate keeper of protection. Given that all firms (and their governments) are completely informed as to one another's costs at this stage, the criterion for the establishment of material injury determines whether or not a

home firm.

²⁵In a finite horizon Prisoners' Dilemma, both countries would introduce the AD apparatus. In our context, countries consider the introduction of AD laws and institutions in a cooperative framework, so that a comparison of home market gains with export losses is appropriate.

petition is filed in each of the signatories²⁶. As was noted above, the discipline of the AD agreement imposes an emphasis upon the effect of unfairly traded *imports* upon the petitioning firm's performance. Exports, may be considered, but are relegated to a lesser order of importance. Given that information as to production costs is complete, knowledge of the material injury criterion and standard ensures that all petitions are, in equilibrium, determined to be in the affirmative. Investigations, however, must be conducted. Firstly, firms will petition upon realizing \underline{c} in their absence²⁷. Secondly, It is a requirement of the ADA. Thus no petition is filed in equilibrium when a firm anticipates that its output for the domestic market is as least as great as would occur in the absence of any adverse shocks. A firm always will file a petition in equilibrium if it anticipates that its output for the domestic market will be less than would occur in the absence of any shocks. A firm will not file a petition in equilibrium if a petition is filed against it by a firm incurring an adverse shock if it anticipates that its output for the domestic market is at least as great as would occur in the absence of shocks. As discussed above, the WTO disciplines use of the ADA to emphasize the impact of unfairly traded imports upon the domestic firm in the market in which it is domiciled. In our context, this is the production level for the domestic market.

²⁶Complete information as to costs precludes strategic considerations in which firms deliberately underperform to raise the probability of an affirmative verdict. See, for example, Hartigan (2002). Industry specific shocks provide a stronger justification for complete information than country specific shocks.

²⁷The investigation provides the evidentiary standards upon which the petition is denied when \underline{c} is realized.

2.3 Stage One: The Introduction of an AD Law

Given that we have an infinite horizon game that repeats a prisoners' dilemma, it is sequentially rational for cooperation to be enforced by its present discounted value exceeding the one period gain from defection, with the latter inducing a punishment phase that is sufficiently dissuasive. Invoking the grim trigger of infinite reversion to the Nash equilibrium of the one period prisoners' dilemma is at variance with the institutional history of the ADA²⁸. What's more, it is not renegotiation proof. Future agents cannot be bound to welfare reducing noncooperative behavior. Cooperation, at a general level, continues, with the perceived instance of defection addressed by the Dispute Settlement Body (DSB) of the WTO. Punitive damages for violations are not permitted. Authorized compensation is intended to restore balance in negotiated concessions²⁹. Instances of retaliation are rare, even after authorization³⁰. The penalty for noncompliance with the AD agreement may be reduced stability of the architecture of trade policy.

Characterizing the loss from defection in a manner that is consistent with institutional practice and provides a stable cooperative equilibrium is much more difficult than specifying a punishment phase. In doing so, we will define cooperation as free trade or as the imposition of AD duties in the period in which an adverse shock occurs in a manner consistent with interpretation of the ADA.

²⁸Compliance with commitments is generally good, even after disputes. (See Epstein, O'Halloran, and Widsten (2009)).

²⁹See, for example, Mavroidis (2000).

³⁰See www.wto.org.

That is, at a level which enables the home firm to produce the output that is optimal in the absence of shocks. Since we have portrayed the implementation of the ADA as reflecting a concern for production for the home market, let us define the periodic gain from cooperation for member I as $G_t(i^I, j^I)$, where i^I is home market output for firm i in the absence of a shock. The per period gain from cooperation is $G_t(i^I, j_{AD}^I)$ in the presence of a shock, where j_{AD}^I is home imports when a shock transpires in the home market. That is, cooperation is free trade in the absence of a shock, and an AD duty that restores the constituent firm's output for the home market to the shockless level in the presence of a shock. We suppose that $G_t(i^I, j_{AD}^I) < G_t(i^I, j^I)$, since the incentive to cooperate is lower under adverse circumstances.

Defection is AD duties that induce an output for the home market in excess of the shockless level after the realization of the shock, or AD protection in the absence of a shock. We denote the (one period) payoff from defection for I as D . This entails a production level $\tilde{i}_{AD}^I > i^I$, where the home government induces uses the AD duty to increase its constituent firm's production for the home market to a magnitude above the shockless level to compensate for reduced competitiveness in its exports to J . There are legal costs incurred through defending an allegation of a violation of the ADA and the attempt at negotiating a settlement. There is a (perhaps intangible) cost to undermining an agreement that permits protection of a constituent firm's home market during the realization of an adverse shock. This includes the probable excessive loss of exports to a market that has incurred an adverse shock if protection of the constituent firm

is not disciplined. In the literature of political science, McGillivray and Smith (2006) have contended that the credibility of punishment for noncompliance with an agreement is enhanced by the threat of punishment of specific leaders through refusal of additional cooperation. This is because voters can depose opportunistic leaders that jeopardize future national welfare. Mansfield, Milner, and Rosendorff (2002) portray the DSB as enhancing information for voters as to the degree of responsibility of their government. The loss from defection for one period is a function of all of the above sources of influence. Periodic loss is denoted by $L_t : L_t < 0$. We can address the periodic payoff under noncooperation within the confines of our model by defining \tilde{i}_{AD}^J as an argument of L to be exports when the antidumping authority of J restores firm j 's level of home production to compensate for lost exports under an adverse shock in J . Hence $\tilde{i}_{AD}^J < i_{AD}^J$. Since the loss of cooperation is not renegotiation proof, let us specify $R : R > 0$ as the cost of restoring the ADA. The discount factor is δ . For cooperation to be an equilibrium strategy³¹,

$$G_t(i^I, j_{AD}^I) > D(\tilde{i}_{AD}^I, i^J) + \delta(L_t(i^I, \tilde{i}_{AD}^J) - R) \quad (10)$$

We are supposing in (10) that the duration of noncooperative behavior preceding successful renegotiation is brief (one period)³². Given that disputes tend to

³¹Note that as presented, our model would predict that cooperation would take place in every period, and that disputes would never arise under the AD agreement in equilibrium. We can accommodate defection by making it a function of period specific (stochastic) influences in addition to the adverse shock that we model formally. Recall, however, that our focus is the proliferation of AD laws and the institutions that implement them.

³²We normalize the payoff to noncooperative behavior at zero. Note that the threshold value of G_t is that level at which cooperation is less attractive. Similarly, the threshold value

be resolved (by statute) relatively quickly, this assumption may not be unreasonable. Thus in a two country WTO, both members introduce AD laws and the institutions to implement them³³.

3 A Model for a Three Country WTO

We expand the membership of the WTO to the triple $\Omega_3 = \{X, Y, Z\}$. Each country $I, J, K = X, Y, Z$ and $I \neq J \neq K$ has a constituent firm, the period t output of which comprises the set $\omega_{it} = \{i_t^I, i_t^J, i_t^K\} \forall i = x, y, z$, with outputs matched to countries by pertinent upper and lower case letters. Once again, i_t^I are home market sales and i_t^J and i_t^K are exports by firm i in period t . The demand (1) and profit functions (2) and (3) are augmented by the output of firm z . The solution for the simultaneous optimal output determination for any country I is

$$i_t^I = (a + 2s - 3c_i + c_j + c_k)/4b \quad (11)$$

$$j_t^I = (a - 2s + c_i - 3c_j + c_k)/4b \quad (12)$$

$$k_t^I = (a - 2s + c_i + c_j - 3c_k)/4b \quad (13)$$

of L_t is that level at which the loss of cooperation is greater.

³³Note that each government weighs its constituent firm's interests at 100 percent. See footnote 11 in Chung and Hartigan (2005) for a detailed justification.

Given the symmetry of the model, $j^I = k^I = i^K = j^K = i^J = k^J$ if all firms realize identical costs.

3.1 Stage Two: The Market Equilibrium

As for the two country WTO, this stage occurs in every period. If there are no AD petitions filed, the market equilibrium is as depicted by (11), (12), and (13) for outputs in country I , with substitutions into the augmented (1) to determine price and into the augmented (2) or (3) as appropriate to determine profits. The equilibria for J and K are generated analogously.

If there is an AD petition, duties are imposed to increase the costs of serving the market of the signatory imposing them. Following our assumption for the two country WTO, we will increase the costs of serving the market that is protected by a AD duty by $\bar{\gamma}$ when the exporting firm has high costs, and $\underline{\gamma}$ when the exporting firm has low costs. Hence $\underline{\gamma} > \bar{\gamma} > 1 \subset \mathbb{R}^+$ ³⁴. Suppose that country I imposes an AD duty on the firms in J and K . The market equilibrium in I will be given by

$$i^I = (a + 2s - 3c_i + \gamma(c_j + c_k))/4b \quad (14)$$

³⁴Note that the values of $\underline{\gamma}$ and $\bar{\gamma}$ are sensitive to whether or not files take place against both exporting firms or a single exporting firm in a three country WTO. That is, higher duties are required to force a single exporter to absorb an adverse shock than when a pair of firms absorb it. The values of $\underline{\gamma}$ and $\bar{\gamma}$ that permit the home firm to produce the output level that would occur in the absence of a shock when the shock transpires are a function of the cost realizations of both exporters. That is, $\underline{\gamma} = \gamma(\underline{c}_j, c_k)$ and $\bar{\gamma} = \gamma(\bar{c}_j, c_k)$ for $j, k = x, y, z$ and $j \neq k$.

$$j^I = (a - 2s + c_i - 3\gamma c_j + \gamma c_k)/4b \quad (15)$$

$$k^I = (a - 2s + c_i + \gamma c_j - 3\gamma c_k)/4b \quad (16)$$

Prices and profits are determined by substitution into the augmented (1), (2), and (3). Solutions are analogous when J and K impose duties. If AD duties are applied to the firm in a single country, $\gamma = 1$ in (14)-(16) for the cost of the firm that does not incur the duty. Comparing (11)-(13) with (14)-(16) reveals an increase in the output of the protected firm and a decrease in the output of the firms encumbered by an AD duty. If one exporter is not burdened by a duty ($\gamma = 1$) and the other exporter is ($\gamma > 1$), the unburdened exporter also sells more in the protected market³⁵.

3.2 Stage Two: The Petition, Investigation, and Verdict

Once again, this stage may take place in every period. As in the smaller WTO, it begins with a drawing of marginal production costs. With a three member WTO, we have the universal dumping model assuring that the existence of unfair

³⁵The recent Bratsk decision in the U.S. is interesting in this regard. This decision directs the investigative authority for the material injury decision, the U. S. International Trade Commission (USITC) to conduct a replacement benefits test in the presence of certain triggering factors. These factors are the (1) filing against imports of a commodity (homogeneous) product, and (2) the presence of price competitive nonsubject imports being significant in the market. If both of these conditions are satisfied, the USITC is directed to conduct a replacement benefits test. In this instance, an affirmative verdict can be reversed on the basis of there not being a benefit to the U.S. industry. The Bratsk decision reflects an awareness of market share or domestic output on the part of the court. This creates an incentive to file against all sources of the import, given that the unfair act decision is almost always positive. The implication is that the market share or output of U.S. producers is of primary importance in the application of the ADA.

pricing always holds and that the material injury decision is the gate keeper of protection. As in the two country WTO, firms file a petition in equilibrium after incurring an adverse shock, but do not file in the absence of a shock. Firms do not, in equilibrium, file retaliatory petitions. That is, they do not file against a firm that has filed against it due to the realization of an adverse shock. All investigations render affirmative verdicts in equilibrium. With a two country WTO, knowing that firm will file a petition upon the realization of an adverse shock leaves no question that the filing must be against the other member. With a three country WTO, knowing that a petition will be filed is necessary, but not sufficient, in disclosing the identity of the firm against which the the accusation of unfair trade occurs. Thus we proceed to a determination of whether a firm incurring an adverse shock files against one or both competitors.

3.2.1 Filing against One Competitor

By filing against one or both competitors after the realization of a shock, a firm can induce its government to preserve its home market output at the shockless level. Since we know that both signatories of a two member WTO will introduce AD legislation and institutions, we now begin to address the primary concern of the paper: will there be diffusion of AD laws and their concomitant institutions? For this assessment, we suppose that all three members become simultaneous signatories of the WTO. The question is whether or not an equilibrium can exist in which two members protect the home market share of their constituent firms, while a third signatory forgoes home market protection if its constituent firm's

exports are not targeted by the AD petitions in the other two members. To consider this, define the countries with AD apparatus by Ω_{AD} .

If firm i incurs an adverse shock, then its output is less than $i = (a + 2s - \underline{c})/4b$ ³⁶. For countries I and J to have an AD apparatus and K to not, then I and J must be willing to absorb all of the effect of the adverse shock upon the home firm's production for its domestic consumers in each other's markets. Using analogues of (14)-(16), this requires that $i = (a + 2s - \underline{c})/4b = (a + 2s - 3\bar{c} + (\gamma_1 + 1)\underline{c})/4b$. Recalling that the firms are drawing cost realizations from the same distribution, this yields $\underline{\gamma}_1 = (3\bar{c} - 2\underline{c})/\underline{c}$. Substituting i into the best response functions of firms j and k , and γ_1 into the best response function of firm j yields outputs in country I of

$$j^I = (a - 2s - 8\bar{c} + 7\underline{c})/4b \quad (17)$$

$$k^I = (a - 2s + 4\bar{c} - 5\underline{c})/4b \quad (18)$$

Thus $k^I > j^I$. That is, firm j exports less to country I than does firm k if both incur the same production costs and the AD duty is assessed only to j .

3.2.2 Filing against Two Competitors

If all three members had AD laws, $\underline{\gamma}_2 = (3\bar{c} - \underline{c})/2\underline{c}$. This is determined by setting $i = (a + 2s - \underline{c})/4b = (a + 2s - 3\bar{c} + 2\gamma_2\underline{c})/4b$, and substituting i and γ_2 into the best response functions for firms j and k . The corresponding output

³⁶Recall that \underline{c} is identical for all firms in the absence of any shocks.

levels in I if neither firm incurs the shock are

$$j^I = k^I = (a - 2s - 2\bar{c} + \underline{c})/4b \quad (19)$$

The benefit to I and J of their constituent firms not filing against k if K does not have an AD law is that they do not have to absorb the adverse shock in K . However, they must absorb all of the adverse shock in one another's markets. As in the two country WTO, we must determine the loss in exports when a single country absorbs all of the adverse shock in another country. Sales by firm j in country I in the absence of an AD law when firm i incurs a shock are $(a - 2s - 2\underline{c} + \bar{c})/4b$. Sales by firm j in country I in the presence of an AD law when j absorbs all of the shock are given by (17). Thus we obtain

$$(a - 2s - 2\underline{c} + \bar{c})4b - (a - 2s - 8\bar{c} + 7\underline{c})/4b = 9(\bar{c} - \underline{c})/4b \quad (20)$$

This is necessarily positive given $\bar{c} > \underline{c}$. Thus exports by j are greater in the absence of an AD law that protects firm i from an adverse shock. When both countries j and k share the cost of insulating i from the output shock in its home market, exports are given by (19). As in the two country WTO, the best response of each exporting firm to the insulation of the home firm from the effect of the adverse shock upon home market production is to export the same volume that would occur in the absence of the shock. That is, firms j and k are precluded from taking advantage of the shock in I by the AD law. Thus firms j and k each forego exports of $(\bar{c} - \underline{c})/4b$. The difference between the cost to j of

absorbing all of i 's adverse shock in I in terms of foregone exports and sharing that shock with firm k is disclosed by subtracting $(\bar{c} - \underline{c})/4b$ from (20). This is $8(\bar{c} - \underline{c})/4b$.

Now that we have determined the excess burden to firm j from absorbing all of the adverse shock to firm i relative to sharing that burden with firm k , we must compare it to the gain from not incurring an AD duty from K when k incurs the shock. This duty is assessed against both i and j . This is because both countries I and J have AD laws. Output by firm $i(j)$ for country K when k incurs an adverse shock is $(a - 2s - 2\underline{c} + \bar{c})/4b$ without the law. When k is protected by an AD law, this becomes $(a - 2s - 2\bar{c} + \underline{c})/4b$ as (19) suggests. Hence the benefit to i and j of K not having an AD law is

$$(a - 2s - 2\underline{c} + \bar{c})/4b - (a - 2s - 2\bar{c} + \underline{c})/4b = 3(\bar{c} - \underline{c})/4b \quad (21)$$

Given the parameter definitions, this is positive. Hence, through comparing $8(\bar{c} - \underline{c})/4b$ with (21), we see that countries I and J prefer to have firm k file against their constituent firms than to have their constituent firms absorb the full effect of the adverse shock on the domestic market of each other. Because signatories receive a greater benefit from protection of the home market for their constituent firms under an adverse shock than those firms lose in exports when the foreign rival incurs a shock in the two member case, this will also hold for more than two members. We have demonstrated that as the number of exporters to a country (in which the shock has occurred) that participate in absorbing the

shock expands from two to three, the cost to an individual exporter of absorbing that shock diminishes. The cost to absorbing the adverse shock in a member is $(\bar{c} - \underline{c})/3b$ when there are two signatories, but falls to $(\bar{c} - \underline{c})/4b$ when there are three. The benefit to home market protection is invariant with respect to the number of WTO members, but the loss in exports from foreign market protection monotonically declines with membership. Hence there is diffusion of AD laws and institutions.

Thus the AD agreement can be viewed as a risk sharing vehicle. In this interpretation, diffusion is desirable if domestic political pressure to sustain home production at some threshold (absence of a shock) level is sufficiently great. Hence a WTO would want to have an AD agreement in which acceptance was mandatory. This permits a proposition.

Proposition 1 *All members of the WTO will introduce and utilize AD laws.*

3.3 Stage One: The Introduction of an AD Law

As in the case of a two country WTO, (10) establishes that members will introduce AD laws and the institutions to implement them. In fact, the ADA is more compelling in a larger institution. The benefit, that of protecting the domestic market in the presence of an adverse shock to a home industry, remains constant. However, the cost of foregone exports when foreign firms incur the shock diminishes with greater membership.

4 Discussion

A primary result of our model is that WTO members want to hold an option to protect their constituent industries against adverse shocks that occur with positive (but not unitary) probability in each period as a condition for participation in a trade liberalizing institution. The ADA satisfies this condition, and serves as a risk sharing vehicle.

A principle implication of our model is that filing patterns consistent with retaliation are also consistent with contemporaneous or proximate realizations (correlated or uncorrelated) of adverse shocks in multiple exporting countries. However, our explanation does not support the retaliatory hypothesis. Our analysis generally consistent with the unilateralism of Ethier (2002) and the pressure of import surges of Bagwell and Staiger (1990), but provides additional insights.

Ethier considers a positive (beneficial) technology shock benefitting an exporting *country* at the expense of an import competing country and another exporting country. His primary concern is with the relationship of the unilateral implementation of protection to the rate of trade liberalization. He demonstrates that the general adoption of unilateralism facilitates liberalization through the alleviation of a time consistency problem and an externality. Time inconsistency arises when liberalization becomes excessive as a result of the technology shock. The externality appears when an exporting country becomes a laggard as a result of the technology shock benefitting the other exporting country. This forms an "insurance triangle" in which discriminatory AD pro-

tection benefits the import competing country and the other exporting country at the expense of the exporting country benefitting from the shock. That is, members share the risk of protecting a home market and an export market. AD protection also enhances the ex ante commitment to liberalization. Ethier's model requires a minimum of three countries to explain the existence of an ADA. His application of AD duties is discriminatory, which is permitted by the ADA. Although he is concerned with the existence of AD laws, he does not address the particulars of the interpretation of the ADA

Our analysis is supportive of that of Ethier. However, we are not concerned with the rate of trade liberalization, taking free trade as given in the absence of shocks. Thus we do not need ongoing trade liberalization to explain the appeal of AD laws. While we address shocks, ours is negative and occurs at the level of the *firm (industry)*. Trade in our model is intraindustry. Although the diffusion of AD laws in our framework is driven by risk sharing (not unlike Ethier's insurance triangle), the attraction of the ADA in our interpretation exists in a two country WTO. While we need an insurance triangle to explain diffusion, we do not need it to explain the existence of an ADA. Our risk sharing differs, as well. Our interpretation of the ADA is a focus upon domestic production in which signatories share the risk of insuring each countries home market from an adverse outcome. Our application may be consistent with the Most Favored Nation (MFN) principle, whereas Ethier's use of AD laws must be discriminatory³⁷. Because nondiscriminatory filing (albeit with the possibility of discriminatory

³⁷Consistency with MFN occurs if neither exporting firm or both exporting firms incur the adverse shock when the home firm does.

duties) serves as a more effective risk sharing vehicle, our interpretation of the ADA is that it approaches a SG. Hence our interpretation of the ADA as a de facto SG³⁸. Thus we are more concerned with interpreting the ADA itself than is Ethier.

Bagwell and Staiger (B&S) (1990) disclose that temporary import surges provide a temptation to defect from a cooperative tariff regime to exploit a terms of trade externality. Because the surge is temporary, it is not a time consistent strategy to revert to Nash tariffs³⁹. To mitigate the incentive to defect, the cooperative tariff must be higher when import surges are more unusual. In our framework, adverse cost shocks are temporary, inducing a protective response by government which is not viewed as a deviation from cooperative trade policy as long as it is consistent with the ADA⁴⁰. Hence the prospect of a shock does not affect the cooperative tariff, which is free trade in our case. While the B&S use of administered protection does insure (perfectly competitive) producers in the domestic market from surges in imports, it does not address risk sharing. It also does not address the proliferation of AD laws and does not provide an explanation for why the WTO instituted an ADA.

³⁸This is consistent with Finger's (1993) view of AD as a de facto SG. He refers to AD as the "poor man's" escape clause, stating that the functional difference in their application is the public awareness of the case. They are used to address very similar economic problems (difficulty in competing with imports), with the distinction between them being in the public's support for restrictions of imports.

³⁹Market shares vary as a draw from a distribution, but B&S do not provide an underlying reason for the variation in shares.

⁴⁰If both foreign and domestic firms incur the shock simultaneously, there would not be a surge in imports. In fact, the level of imports would diminish, as the equilibrium price would be higher than in the absence of any shocks.

5 Conclusion

The theoretical modeling in this paper offers a plausible explanation for the diffusion of antidumping law adoption and antidumping petitions amongst new WTO members. Our analysis offers a justification for the inclusion of the ADA in the Uruguay Round that established the WTO. The model has an infinite horizon and three countries. Each country has a domestic industry producing output for its domestic market and for exports to the two other markets. The existence of transport costs results in universal dumping and market segmentation. Each country is faced with the possibility of a periodic adverse cost shock to its import competing industry with an uncertain timing. Under these assumptions we show that the adoption of an AD law in the initial period of the game is a dominant strategy for all countries. The adoption of such a law permits each WTO member to take an affirmative antidumping action whenever an adverse cost shock results in a loss in domestic market output of the import competing industry and a rise in imports. Trade partners accept AD actions that safeguard the domestic market output of the adversely affected country. This implies that they forego a rise in exports resulting from the adverse shock abroad. Their constituent industry continues to export the same volume as would occur in the absence of an adverse shock to the import-competing industry. This implies that trade partners agree to absorb the cost of an adverse shock abroad, knowing that when they incur an adverse shock, other WTO countries will reciprocate. Cooperation is in place due to the risk sharing of the ADA, safeguarding domestic production for each of the signatories.

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