

# The Economic Effects of Widespread Application of Anti-dumping Duties to Import Pricing

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## Abstract

*We provide an analysis of the implications of widespread use of anti-dumping (AD) duties to welfare and sectoral resource allocation in the context of a computable general equilibrium model of trade among three open economies. Production of the dumped good has a decreasing-cost technology, thus allowing the endogeneity of the number of firms in the home and foreign markets. AD duties in this general-equilibrium framework have the protective effects of the tariffs they are; the economies have the dual distortion of the original dumping and the imposed tariff. AD duties only promote free trade when they are effective in deterring anti-dumping duty. Firm entry in the dumping country or removal of transshipment restrictions are more effective anti-dumping policies than the AD duty.*

## I. Introduction

Dumping occurs when a firm charges a price in the foreign market below its price in the domestic market when it supplies the identical good to both

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markets.<sup>1</sup> Provisions within the GATT allow member countries to impose anti-dumping (AD) duties to counteract this behavior and return the price of the dumped goods to its "fair value". The increasing incidence of dumping allegations and imposition of anti-dumping (AD) duties indicate that dumping of exports in foreign markets is a growing concern in international trade and policy discussions. Other studies have presented in detail the evolution and present ubiquity of AD investigations and duties in import-competing countries, and have also addressed the issue of whether these trends truly indicate a rise in dumping activity.<sup>2</sup> In this paper we focus on a separate theoretical issue: what is the impact of widespread dumping and use of AD duties on the exporting and importing economies?

Policy discussions often yield the response that dumping is an unfair trade practice and the appropriate AD duty restores outcomes obtained through fair trade (*i.e.*, the predumping outcome). We take this response as our null hypothesis and compare it to the alternative hypothesis that AD duties do not eliminate the distortions to the world economy inherent in dumping behavior but rather introduce a protectionary distortion that can further reduce the welfare of trading partners. This latter distortion has an impact similar to that of protective trade policies like tariffs or quotas. Our analysis will first examine the relevant theoretical evidence on dumping and the incidence of AD duties. We focus on dumping as a response to segmentation of domestic from foreign markets, the so-called "classic theory of price discrimination" (Deardorff [1988], p. 24). Then we specify an archetypal computable general equilibrium (CGE) model in which dumping is rational firm-level behavior to compare the quantitative effects of AD duties on the economies relative to the effects of both fair trade (*i.e.*, non-dumping) and of other protective policies.

Our analysis indicates that while the credible *threat* of imposition of AD

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1. Dumping, according to the GATT, could also be selling below cost in the export market even if the same is occurring in the domestic market. Deardorff (1988) provides more detail on this.
  2. Finger (1993) reviews antidumping regulations and makes quite strongly the case that these regulations are being used not to protect against unfair competition but simply to protect. His bibliography provides a thorough summary of previous analyses of antidumping regulations.

duties can maintain the world economy at a fair-trade equilibrium, actual imposition in response to observed dumping is less likely to do so. This difference hinges on the ability of the policy-maker to react immediately to dumping activity with AD duties that counteract completely the actual dumping margin. A rational firm confronted with an otherwise-profitable dumping opportunity and these AD duties will forego the opportunity and fair trade will be maintained. The protectionist distortions of AD duties occur when they respond less precisely to dumping activity.<sup>3</sup> The dumping firm is not discouraged from dumping activity, but the AD duties applied *ex post* introduce a wedge between home and foreign prices of the good in addition to that due to dumping behavior. The relative price structure in international trade and in the exporting country with dumping and AD duties will thus be quite different from that in the absence of dumping.

The revenue effects of an observed AD duty provide another reason that the fair-trade outcome is not maintained. When AD duties are imposed in response to observed dumping behavior on a substantial share of imports the resulting revenues from the duties provide a substantial transfer from the exporting country to the importing country that will affect economic decisions in both countries. These conclusions together suggest that the null hypothesis will not hold and raise the possibility that the net effect of dumping and the imposition of AD duties will in fact be quite protectionist for the importing country. Simulations with the CGE model support these conclusions and indicate that the protectionist effects of AD duties can be quantitatively quite significant.

AD duties, whether threatened or imposed, are efforts to regulate international trade. Other possibilities exist for such regulation, including imposition of quotas and negotiation of voluntary export restraints. We compare and contrast the quantitative impact of these with that of AD duties using data from the CGE simulations. We do not consider here export subsidies, the other

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3. This latter effect of AD duties is more likely when material injury must be demonstrated before the duty can be imposed—then there can be a substantial period of trade with profitable dumping before the duties become effective. Two features of anti-dumping law can minimize this lag in enforcement: duties based on the threat of material injury and duties retroactive to the initial incidence of dumping.

trade practice often cited as unfair and countervailable under the GATT.<sup>4</sup> The methodology and tests employed here are easily transferable to that case.

Given its reduced welfare, the government in the exporting country may well want to reduce the barriers that allowed market segmentation and thus remove the rationale for dumping. We discuss two methods: trade liberalization to allow dumped goods to be reimported at the lower price, or an industrial policy liberalization to encourage firm entry into the dumping sector. Either will be successful in stopping dumping at its source, although the second involves an increase in fixed costs in this model that is itself welfare-reducing.

## II. Analytical Discussion of Dumping and AD Duties.

There is a substantial existing literature on economic rationales for dumping. The earliest discussions concluded that dumping would be profit-maximizing for the private firm if the price elasticity of demand is larger in absolute value in the export market than in the home market and if the two markets could be segmented – *i.e.*, prevented from cross-trading with each other.<sup>5</sup> More recently, analysts have advanced other theories of dumping as an intertemporal phenomenon. Dumping in this case drives competitors out of the market and thus permits monopoly pricing in future periods that increases the discounted value on net.<sup>6</sup> We focus on the classic theory of the

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4. Gruenspecht (1988) provides a theoretical exposition of the effects of export subsidies in a model of international trade in differentiated products. de Melo and Roland-Holst (1993) provide a CGE analysis of the impact of export subsidies on trade.

5. This "classic theory" was first described by Viner (1923) and Barone (1921); Robinson (1933) identified it as discriminating monopolistic behavior. Anderson (1992) and Staiger and Wolak (1992) present the reaction of the exporting firm and the importing country industry, respectively, to antidumping legislation. Recent analyses have incorporated oligopoly theory with the Viner/Robinson insight to explain inter-industry trade, or what Brander and Krugman (1983) call 'reciprocal dumping.' Dixit (1988) and Webb (1992) provide other analyses of dumping behavior in an oligopolistic setting.

6. Ethier (1982) and Davies and McGuinness (1982) suggest that dumping as the sale of products below average or even marginal cost can be a rational response to a temporary downswing of goods demand. Williamson (1977) and Areeda and Turner (1978) consider predatory dumping, where temporary dumping below average or marginal

impact of dumping and AD duties. We believe, however, that an useful extension to this work would be to model similarly the intertemporal theories of dumping.<sup>7</sup>

### ***A. Dumping as a Rational Response to Market Segmentation***

The Viner/Robinson insight on dumping behavior is a simple application of the microeconomic theory of price discrimination through market segmentation. If a firm is unable to segment a market, its profit maximizing strategy is to set a unique price for all markets. Marginal revenue depends upon the price elasticity of demand for the product ( $\Delta$ ); in this case  $\Delta$  is a weighted average of the price elasticities of demand in the two markets ( $\Delta_x, \Delta_h$ ). Price exceeds marginal revenue for firms with market power, with the gap between the two narrowing as demand grows more elastic (as the price elasticity of demand grows in absolute value). If two markets are segmented and the price elasticities of demand in the two markets differ, the firm can earn even higher profit by setting different prices in the two markets. If demand is more elastic in export market  $x$ , then the profit-maximizing price for the identical good will be less than the price charged in the home market  $h$  and profit-maximizing behavior leads to dumping. The dumping margin, or the percentage difference in the prices, will depend upon the difference in price elasticities of demand.

In oligopolistic or monopolistically competitive industries, the firm must consider not only the market demand elasticity but also the share of that market it will be able to capture or retain from the competition. The marginal revenue in the criterion is replaced with a perceived marginal revenue. This perception reflects the firm's perception of each market's price elasticity of demand to changes in its price and must incorporate some notion of how the competitor firms will respond. The interactions of these firms can be described in a number of ways, and as Eaton and Grossman

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cost can increase the discounted value of total profits. Clarida (1993) relates dumping to technological knowledge. Hartigan (1992) considers the anti-dumping investigation process as an information-revelatory mechanism.

7. The mathematical form of these conclusions is contained in Annex A, available upon request.

[1986] point out the results obtained may be sensitive to the method chosen. We choose to employ the conditions of a Cournot-Nash equilibrium with symmetric firms, and in this case find that the firm's perceived price elasticities of demand ( $\delta_x, \delta_h$ ) are related to the number of firms competing in the market ( $n_h, n_x$ ) and to the market elasticities ( $\Delta_x, \Delta_h$ ) in the form  $\delta_i = n_i \Delta_i, i = h, x$ .<sup>8</sup> The perceived price elasticities thus rise both with the market elasticities and with the number of competing firms. These  $\delta_i$  are used by the firm in setting prices in the two markets, and when  $|\delta_x| > |\delta_h|$  dumping will occur.

Dumping is made possible by two preconditions: the opportunity to sell the same good for two prices in the two markets, and a difference in perceived elasticity of demand in the two markets. The first must be a product of trade policy, for without some trade restriction the trade of goods would eliminate this opportunity. The second may be due either to reasons of market demand differences or to different degrees of competition in the two markets.

National welfare of the exporting country is ambiguously affected by dumping. Welfare accruing from the dumping sector has two components: the consumer surplus from domestic consumption and the profits earned by producers on domestic and foreign sales. Part of the increased profits earned by producers is a transfer from consumers, and will thus not be a net addition to welfare. For welfare to rise the increase in profits from foreign sales must exceed the reduction in consumer surplus. National welfare in the importing country is improved. Profits for the import-competing firms fall but serve as a transfer to consumers in that country. The added increase in consumer surplus from the availability of lower-priced imports leads to the improvement in welfare.

### ***B. Impact of AD Duties***

The importing country is entitled under the GATT and obliged by law in

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8. In a Cournot-Nash equilibrium each actor assumes that his competitors' choice will not respond to any change in his own choice. Dixit (1986) provides a useful discussion of alternative equilibrium concepts.



many countries to impose an AD duty to counteract the effect of dumping. Its purpose can be outlined by reference to the home ( $P_h$ ) and export ( $P_x$ ) prices of the dumped good and the resulting dumping margin ( $DM = (P_h - P_x)/P_x$ ). The price of the dumped good in the importing country is  $P_f$ , and if the real exchange rate of the importing country is  $e_f$  the following relationship links these.

$$P_h = (1 + DM) P_x = P_f/e_f \quad (1)$$

Given this relationship, an AD duty equal to  $DM$  placed on the dumped import would raise its price in the importing country to  $e_f P_h$  and remove the exporter's advantage in the importing market introduced by dumping.

This does not necessarily return the world economy to the fair trade equilibrium, because it leaves in place the fundamental segmentation of markets that makes dumping possible. That segmentation allows the dumping firm to set its prices differentially to maximize profits. This point is most clearly made by considering firm behavior when the AD duty is perceived not to offset dumping activity completely due to long lags in implementation, long lags in repeal once dumping has stopped, or uncertainty about whether AD duties will be assessed once dumping begins. In this instance profit-maximizing behavior defines a strict relationship between  $P_h$  and  $P_x$  that can be written

$$P_h = (1 + [(\delta_h - \delta_x)/\delta_x(\delta_h + 1)])P_x \quad (2)$$

Comparing equations (1) and (2) reveals that the term in braces defines the dumping margin, and its components are not factors that are reversed by the imposition of the AD duty. The firm accepts the duty as a cost of doing business independent of its dumping activity and as such is not deterred from dumping.

What then does the AD duty do? Since it cannot close the wedge between  $P_h$  and  $P_x$ , it rather will put pressure on  $P_h$  and  $P_x$  to fall, on  $e_f$  to fall (or appreciate) and will provide protection for  $P_f$  to rise. This will further distort the relative prices in both economies and in the trade between the economies; *i.e.*, it will have the customary effects associated with protective tariffs.

At the opposite extreme, the threat of a completely offsetting AD duty is

effective in maintaining the world economy at its fair-trade equilibrium.<sup>9</sup> Beginning with no market segmentation (our definition of fair trade), a rational firm faced with the opportunity of segmented markets and the threat of a Type II duty will find its interests best served by maintaining its fair-trade behavior. Any move to raise the domestic price  $P_h$  to exploit the segmented markets would raise  $P_f$  in the export market as well, restricting the size of that market without passing on the increase in price through the export price  $P_x$ . This anticipated loss to the exporting firm induced by the AD duty causes the firm to revise equation (2) and to conclude that it cannot improve upon  $P_h = P_x$  at the fair-trade equilibrium.

AD duties thus share on a smaller scale a property of nuclear weapons. Threat of their use can induce desirable behavior. However, once they are deployed they leave existing distortions intact and introduce new disasters. This independent distortionary effect is noted in the economics literature. Deardorff [1988, p. 27] notes in his survey of classic dumping that "... it would appear that restrictions against dumping from the importing country's point of view make no economic sense. This conclusion is reinforced if one considers specifically the welfare of the importing country." Dixit [1988] finds no rationale for AD duty imposition in an oligopolistic version of the classic dumping model.

### ***C. AD Quotas, Voluntary Export Restrictions and Negotiated Settlements***

Given the problems in reattaining the fair trading outcome through use of AD duties, policy-makers may well be tempted to employ an AD quota of imports from the dumping country at the fair-trade (*i.e.*, pre-dumping) level. This will maintain imports at the fair-trade level, but will not remove the market segmentation and the incentive to dump. Setting up a single quota-holder could lead to positive welfare gains for the importing country, but

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9. In game-theoretic terminology, with an uncertain or sluggish AD duty the exporting firms have Cournot-Nash conjectures about government imposition: they anticipate no use of AD duties in reaction to their decision to dump. With the complete AD duty the government has made a credible commitment beforehand, perhaps through legislation, that it will promptly and completely counteract any dumping activity. The government thus has a "Stackelberg leader" position, with the firms behaving as "Stackelberg followers" in internalizing the government's credible commitment.



the more likely scenario of competition among importing-country residents to import under the quota will leave most of the profits in the hands of the exporting firms. This would lead to larger diversions from the fair-trade outcome (a quantitative example is presented in the subsequent simulations section). This policy therefore retains the distortions of market segmentation and of protection.

An extreme example of this latter effect occurs under the voluntary export restriction; the exporting firms will in this case capture the entire profit from export sales. This restriction may in fact encourage collusion among the competitors to such an extent that they begin to act as monopolists in the export market. This would lead to restrictions of exports to levels lower than those at the fair-trade equilibrium, since the number of competitors would be reduced to  $n_h + 1$ , and the resultant higher prices in the export market.<sup>10</sup>

Negotiated settlements of AD duty cases are another outcome that the theory would predict. Exporting firms unsure of the timing and completeness of AD duty response would dump in the export market. Once the importing country threatened a prompt and complete response to the dumping, the exporting firms could reach agreements leading to a cessation of dumping at a negotiated price in the export market. This could be the fair-trade price, leaving the exporters with the profits incurred until the duty was imposed; it could also be a higher price that reflects the collusion of the exporting firms in the negotiation process.

#### ***D. General-equilibrium Considerations***

We mention here variables that should, more properly, be considered endogenous in a discussion of the effects of dumping and AD duties. Detailed analysis will be presented in the context of the simulation model and its results.

**Wages:** Dumping that expands the production of its sector will put upward pressure on wages in the exporting country under conditions of full employ-

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10. If this coordination also led to collusion in the domestic market there would be monopoly pricing there as well.

ment. With less-than-full employment the shadow wage appropriate to the cost function will be rising. Dumping need not expand the production in its sector, however; concomitantly with an increase in sales on foreign markets there is a reduction in sales to the domestic market due to higher  $P_h$ . The net result on output and employment is ambiguous.

**Relative Prices in Other Sectors:** Though dumping is a sector-specific activity, it affects prices in other sectors through its impact on national income and factor allocation. This will lead to altered demand and supply decisions in all sectors.

**Income Effects of the Policy:** The allocation of income both within and across countries will change. In the exporting economy the dumping-sector profits will rise relative to other sectoral profits and to wages; in the importing economy the converse will occur. These income effects will change demand for all goods, both at home and abroad. To the extent that the winners from this policy have different consumption patterns than the losers, there will be additional shifts in demand due to the income redistribution.

**Other Government Policies:** Trade and industrial policies in a country generate the dumping opportunity. The former insulate the dumping country from the importing country, preventing the reverse flow of goods from where they were dumped to the home market at their lower price. Industrial or other barriers protect the existing producers from domestic competition. Change in either of these will radically alter behavior in the dumping sector and by extension in the economy as a whole. In the derivation underlying equation (2), factors that influence the size of the  $\delta_i$  will influence the size of the dumping margin. If, for example, the barriers to intra-market trade were removed all firms can sell in all markets ( $n_h = n_x$ ) and the wedge between  $P_h$  and  $P_x$  disappears. Encouragement of entry of firms into the dumping sector will also reduce dumping margins even though market segmentation remains.

### III. A CGE Model of Dumping and AD Retaliation.

In this section we specify a CGE model of international trade to investigate the quantitative impact of dumping and AD duties on the trading economies and to compare that with the impact of protective policies. This

model of three trading regions is not calibrated to represent any specific set of economies, but rather to provide a quantification of the effects of such commercial policies within a theoretical trade model.

The model for each country is quite similar to other CGE models, especially those inspired by World Bank research (Dervis, de Melo and Robinson [1982], de Melo and Tarr [1989]) although with less sectoral detail. Each country is characterized by monopolistic competition in one trading sector, and in that we follow the work of Devarajan and Rodrik [1989].

There are, however, two areas in which this model departs sharply from the existing literature. First, it is designed "from the inside out." Instead of calibrating the model to replicate the observed behavior of a specific country, we begin as in trade theory with endowments, technology and tastes and have derived the implied behavior.

Second, it endogenizes the trade pattern between the three regions. In one set of simulations we look at two of the countries in isolation, so that the export demand relevant to country *A* is simply the import demand of country *B*. This removes a source of possible inconsistency in the other, single-country, models and introduces explicitly the game-theoretic behavior at the base of retaliatory commercial policy as discussed here.<sup>11</sup> In the subsequent simulations we examine trading behavior of these two countries between each other and with a large third region that sets world prices. This specification of trading patterns is chosen to approximate more closely the incidence of dumping in countries small relative to the world market.<sup>12</sup>

We present the salient features of the model in Table 1.<sup>13</sup> There are three goods produced and consumed, of which two are traded. Of the two traded goods, one is a decreasing-cost industry denoted *T1*, and the pattern of endowments assumed of productive factors implies that country *B* is its comparative-advantage producer. Country *A* has the comparative advantage in a constant-cost industry producing the good *T2*. The large world region

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11. For example, export demands in single-country models are specified in an ad hoc fashion that may imply unrealistic parameters of demand for imports in the trading partner.

12. We have performed the following simulation exercises as well for trade between two countries in the absence of the third region. Those results are available on request.

13. Annex A presenting the model in detail is available upon request.

**Table 1**  
**Features of the CGE Simulation Model**

- There are two countries: *A* and *B*.
- There are three factors of production: capital (*K*), unskilled labor (*L2*) and skilled labor (*L1*).
- There are three sectors: an increasing-returns tradeable (*T1*), a constant-returns tradeable (*T2*) and a non-tradeable (*NT*).
- *B* has equal endowments of the three factors, while *A* has preponderance of *K* and a shortage of *L2*.

	Country <i>B</i>	Country <i>A</i>
<i>L1</i>	200	200
<i>L2</i>	200	300
<i>K</i>	200	100

- The production technology is Cobb-Douglas and identical in each country. The income shares of the three factors in production of the three goods is

	<i>L1</i>	<i>K</i>	<i>L2</i>
<i>T1</i>	.2	.2	.6
<i>T2</i>	.2	.6	.2
<i>NT</i>	.6	.2	.2

- Demand for the goods is Cobb-Douglas and identical in each country; shares of income spent on the three goods are: *T1* = .3, *T2* = .4, *NT* = .3.
- These parameters are chosen so that *B* is relatively well endowed in those factors intensive in *T1* production, while *A* is relatively well endowed in the factors intensive in *T2* production. The relative prices of the two goods in autarky lead to *A*'s export of *T2* and *B*'s export of *T1*.
- The imported good is combined with the domestic good of the same name in an Armington CES composite consumption good. This function takes the form (for country *B*) of

$$CD = AM * (BM * IMP^{CM} + (1 - BM) * DS^{CM})^{(1/CM)}$$

with  $CM = (SIGM - 1)/SIGM$  and  $SIGM$  the substitution elasticity between domestic ( $DS$ ) and foreign ( $IMP$ ) goods in composite demand ( $CD$ ). Parameter values are:

		Country <i>B</i>	Country <i>A</i>
<i>AM</i>	<i>T1</i>	1.00	1.89
	<i>T2</i>	1.69	1.00
<i>BM</i>	<i>T1</i>	—	0.30
	<i>T2</i>	0.24	—
<i>SIGM</i>	<i>T1</i>	—	1.20
	<i>T2</i>	1.20	—

The  $AM$  and  $BM$  parameters were calculated to fit the initial conditions on prices and quantities that generated 20 units of  $T1$  export by country  $B$  and 20 units of  $T2$  export by country  $A$ . Country  $B$ 's exports are constrained to equal country  $A$ 's imports, and *vice versa* in the two-country scenario; in the three-country scenario only overall balance is required.

- Imperfect competition is introduced by considering  $T1$  to require an initial cost denominated in factors of production to begin production. These initial factors are assumed used in the proportions of directly productive factors, and are assumed to be 10% of the factor use in Country  $B$  (the lower-opportunity cost supplier of  $T1$ ).

The number of firms is derived endogenously to be consistent with that degree of barrier to entry under the assumption of Cournot behavior.

An initial simulation using country  $B$  in autarky is run to define simultaneously the number of firms in operation and the fixed cost per firm in units of factors of production.

The results are:

$$N = 2.0; \text{FIXL1} = 1.136; \text{FIXK} = 1.000; \text{FIXL2} = 4.167$$

That fixed cost is then presumed necessary for a firm in either country wishing to produce  $T1$ . Its pricing is oligopolistic, thus allowing super-normal profits (also derived endogenously).

- Welfare is measured in each economy by a Graham-Mill welfare function (Cobb-Douglas in form) using the consumption quantities derived endogenously and the consumption shares given above.

is the next lowest-cost producer of each traded good. Each country also produces a non-traded good  $NT$ .

Considerations of dumping requires assumptions as well about the form of market segmentation among the three regions. The  $T1$  producers of country  $B$  are assumed to be able to segment both domestic and country- $A$  markets from large-country suppliers; there are thus potentially three different prices for  $T1$ , even when converted into a common currency. In equilibrium the dumping country also finds it profitable to export  $T1$  at the world price to the third country and imports  $T2$  in return. Country  $A$ 's market is closed to resale of  $T1$  in the third country.

The analytical discussion above highlighted the importance of the number of firms competing in determining the dumping margin and thus the characteristics of equilibrium in the world economy. We specify the technology of  $T1$  production to require a fixed-cost investment; this introduces a rationale for monopolistic competition or oligopolistic behavior and a finite number of firms supported in each market. Such decreasing-cost technology is not essential to dumping, but its assumption provides an easy way to compare

our results with those of Brander and Krugman [1983], Dixit [1988] and others. In our initial simulations we further assume that  $T1$  production is limited to two firms in each economy. The number of firms competing in each market will differ from this; with no market segmentation all four firms will compete in each country, while with market segmentation the competition in the dumping country is limited to the two home firms ( $n_h = 2$ ) while the two face the competition of the two foreign firms in their export market ( $n_f = 4$ ). In subsequent simulations we relax these assumptions to allow for firm entry in the dumping sector of the  $T1$ -exporting country.

The results that follow are organized by international trading structure: autarky, trade with no market segmentation, dumping, dumping *cum* AD duty, and equivalent tariff in the absence of dumping. Examination of the null and alternative hypotheses require comparison of the dumping/AD duty and equivalent tariff scenarios with the no-market-segmentation scenario; the tables making that comparison are thus presented in terms of percentage deviations of variables from their no-market-segmentation values. For the null hypothesis to hold, there should be no difference between the no-market-segmentation and dumping/AD duty scenarios. It is rejected in favor of the alternative if the dumping/AD duty and equivalent tariff scenarios diverge in a systematic way from the no-market-segmentation case with any non-systematic variation attributable to the continued phenomenon of dumping. If they diverge in an unsystematic fashion then the alternative hypothesis should be respecified.

### **A. Autarky**

When the two economies are examined in autarky, they reveal the desired pattern of comparative advantage as illustrated in Table 2. Country B has the lower relative price of the good  $T1$  and country A correspondingly has the lower relative price of  $T2$ .<sup>14</sup> The profits per firm in the two countries in the oligopolistic  $T1$  sector are 17.83 in B and 15.47 in A, respectively.

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14. These relative prices are 1.76 in country B vs. 2.79 in country A. It is more precise when looking at global welfare to examine the relative marginal costs of production, since the relative price of  $T1$  in the two countries is perhaps dependent upon the industrial policy limiting the number of firms. Comparative advantage is revealed more starkly through that comparison: .88 in country A vs. 1.39 in country B.



Table 2

## Autarky and Trade: Indications of Comparative Advantage and Welfare

			Autarky	Fair Trade	Percentage Increase
<b>Country B: the Exporter of T1</b>	Output	T1	43.48	68.83	58.30
		T2	101.66	77.53	-23.73
		NT	80.24	80.72	0.60
	Profit/Firm		17.83	19.45	9.09
	Consumption	T1	43.48	49.84	14.62
		T2	101.66	100.80	-0.85
		NT	80.24	80.72	0.60
	GNP		267.48	269.07	0.59
	Consumer Prices	T1	1.85	1.62	-12.43
		T2	1.05	1.00	1.90
		NT	1.00	1.00	0.00
<b>Country A: the Importer of T1</b>	Marginal Cost in Production	T1	0.92	0.98	6.52
		T2	1.05	0.99	-5.71
		NT	1.00	1.00	0.00
	Factor Prices	L1	0.39	0.39	0.00
		L2	0.32	0.38	18.75
		K	0.45	0.38	-15.56
	Welfare		73.39	76.34	4.02
	Indicators of comparative advantage Relative Price of T1: 1.76 Relative Marginal Cost of T1: 0.88				
	Output	T1	30.31	28.10	-7.29
		T2	112.10	122.18	9.00
		NT	75.14	68.70	-8.57
<b>Country A: the Importer of T1</b>	Profit/Firm		15.47	2.54	-83.58
	Consumption	T1	30.31	46.28	52.68
		T2	112.1	98.65	-12.00
		NT	75.14	68.70	-8.57
	GNP		250.46	229.02	-8.56
	Consumer prices	T1	2.48	1.48	-40.32
		T2	0.89	0.93	4.49
		NT	1.00	1.00	0.00
	Marginal Cost in Production	T1	1.24	1.25	0.08
		T2	0.89	0.93	4.49
		NT	1.00	1.00	0.00
<b>Characteristics of the Trading Equilibrium</b>	Factor Prices	L1	0.37	0.36	-2.70
		L2	0.63	0.62	-1.59
		K	0.28	0.30	7.14
	Welfare		67.15	70.53	5.03
	Indicators of comparative advantage Relative Price of T1: 2.79 Relative Marginal Cost of T1: 1.39				
	World Prices		Exchange Rates		Goods Trade
	T1	1.36	ER	1.19	T1 18.99
	T2	1.10	ERA	0.84	T2 23.53
	NT	1.00			

Note: Simulations using a third large country were calibrated to yield results identical to those reported in the second column of this table.

## ***B. Trading Equilibrium***

International trade causes the expected changes in sectoral production and income structure as indicated in the final column of Table 2. Country *B* specializes in production of *T1* while country *A* specializes in *T2*. The returns to the relatively abundant factors (*K* in country *A*, *L2* in country *B*) rise, while those of the relatively scarce factors (*L2* in country *A*, *K* in country *B*) fall. Relative prices of the comparative-advantage good rise in each country. Since the non-traded good is treated as a *numeraire* in each country, trade defines a real exchange rate (ER/ERA) relating those *numeraires*.

Country *A* imports 18.99 units of *T1* and exports 23.53 units of *T2*. Trade is balanced between the two countries. Welfare rises in both countries. GNP measured in units of *NT* proves to be a misleading indicator of welfare; it rises by only .6% in country *B* and in country *A* falls by 8.6%, but in both cases purchasing power rises by more due to the fall in the price of tradeable goods.

We created the reference equilibrium with no market segmentation through simulation of trade between countries *A* and *B* alone. The "fair trade" outcome is one of trade only between *A* and *B*. However, one measure of the degree to which dumping and AD duties change the equilibrium will be the importance of trade with a large third region, which has relative prices identical to those achieved in the reference equilibrium.

## ***C. Dumping***

The earlier theoretical sections demonstrated that a divergence between perceived price elasticity of demand in the two trading economies will provide a rationale for dumping. This divergence is in evidence in the present model in the market for *T1*; even though the market elasticity of demand is always equal to  $-1$ , the difference in the number of competing firms leads to a perceived foreign elasticity ( $\delta_x = -4$ ) greater in absolute value than the perceived home elasticity ( $\delta_h = -2$ ) for producers in country *B*. Table 3 illustrates in its second column the percentage deviation from the trading equilibrium resulting from dumping in the segmented markets in the absence of an AD duty retaliation.

When market segmentation allows the export price to diverge from the

domestic price the *T1* producers in country *B* will create a dumping margin of .50 to maximize firm-level profits. This margin is absorbed by both domestic consumers and foreign consumers, as the consumer price of *T1* rises 20.3% in country *B* while it falls 4.4% in country *A*. This enables *T1* producers in country *B* to increase profits per firm by 14.1%.

The opportunity to dump does not lead to an increase in output of *T1* in country *B*. Although exports increase with the dumping strategy, domestic consumption falls by more and leads to a 4.4% drop in *T1* output. GNP rises in the dumping country, but that is an artifact of the artificially high price of *T1*; welfare as measured by actual consumption quantities fell by 3.3% as losses in consumers' surplus outweighed profit-taking in the dumping sector. Factor prices move very little in response to the decision to dump; there is a slight fall in the return to *L2*, the factor used intensively in production of the dumped good, in response to the cut in production. The lower prices of *T1* in the foreign market also bring about a 5.9% depreciation of the country-*B* real exchange rate (ER/ERA).

The importing country receives conflicting signals on the impact of dumping. Measures often taken as indicative of the effect of dumping on the economy will indicate a strongly negative impact. For example, there is evidence of "material injury" as required for retaliation under GATT Article VI: imports of the dumped good grow by 15.8%, and the market share of foreign firms in total consumption rises from 41 to 45%. However, these give a misleading signal of overall welfare: dumping leads to a 1.5% increase in welfare in country *A* due mainly to the drop in the average price of *T1*. There is in fact a slight increase in *T1* production and profits in the *importing* country. The quantity demanded for consumption rose faster than exports due to increased purchasing power. This is an artifact of the Armington assumption of imperfect substitutability between the imports and domestically produced *T1* and understates the potential for material injury.

#### ***D. Anti-dumping Duties***

Given the clear indication of dumping behavior in the model and the "threat of material injury" evident in imports and market share, country *A* would be entitled under the GATT (and obliged under the laws of many countries) to impose an AD duty on country *B*'s exports of *T1*.

**Table 3**  
**General-Equilibrium Impact of Dumping and Retaliatory Tariffs**  
**Two Countries Facing the Rest of the World**  
 (Fair Trade Benchmark in Levels; Other Entries in Percent Changes)

			Fair Trade	Dumping	Dumping/ AD Duty	Equivalent Tariff
<b>Country B: the Exporter of T1</b>	Output	T1	68.83	-4.37	-4.75	0.00
		T2	77.53	2.00	2.50	0.00
		NT	80.72	1.76	1.59	0.00
	Profit/firm		19.45	14.13	12.80	0.00
	Consumption	T1	49.84	-15.40	-15.49	0.00
		T2	100.80	2.98	6.52	0.00
		NT	80.72	1.76	1.59	0.00
	GNP		269.09	1.75	1.58	0.00
	Consumer Prices	T1	1.62	20.32	20.32	0.00
		T2	1.07	-1.40	-4.86	0.00
		NT	1.00	0.00	0.00	0.00
<b>Country A: Importing T1</b>	Output	T1	28.10	0.82	1.10	0.00
		T2	122.18	-0.27	-2.09	0.00
		NT	68.70	0.03	2.88	0.00
	Profit/Firm		2.54	1.77	1.81	0.00
	Consumption	T1	46.29	4.95	-7.96	0.00
		T2	98.65	0.10	3.97	0.00
		NT	68.71	0.02	2.87	0.00
	GNP		229.02	0.02	-0.55	0.00
	Consumer Prices	T1	1.48	-4.39	12.09	0.00
		T2	0.93	0.11	-0.86	0.00
		NT	1.00	0.00	0.00	0.00
<b>International Indicator</b>	World Prices	T1	1.37	0.00	0.00	0.00
		T2	1.10	0.00	0.00	0.00
		NT	1.00	0.00	0.00	0.00
	Exchange Rates	ER	1.19	-5.71	-20.08	0.00
		ERA	0.84	0.24	-0.71	0.00
	World Price Dumped Goods		1.16	1.37	1.37	
	Goods Trade (B to A)	T1	18.99	15.85	-27.48	-100.00
		T2	23.53	-1.79	-27.51	-100.00
	Trade with Rest of World	Country B Exports	0.00	1.66	9.67	18.99
		Country A Imports	0.00	1.98	11.97	23.53
		Country B Imports	0.00	0.00	0.00	23.53
		Country A Exports	0.00	0.00	0.00	18.99

If the exporting firms perceived country *A* as credibly committed to immediate imposition of a completely offsetting AD duty in response to dumping then the duty would have its desired effect. Simulation of this case would include no price discrimination by the exporting firms and no imposition of AD duty by the importing country – in other words, the outcome would be identical to that in the fair-trade equilibrium of column 1 in Table 3.

However, sluggish imposition of an AD duty by country *A* equal to the dumping margin generates a new equilibrium illustrated by the percentage changes listed in the third column of Table 3. (These are percentage changes relative to the initial trading benchmark.) These simulations make the point quite forcefully that use of the AD duty to retaliate against existing dumping does not re-establish the pre-dumping equilibrium. Dumping will coexist with the AD duty, introducing a second distortion to the world trading economy. The degree of dumping may be altered or not, as noted in the theoretical section, but the end result is an outcome with striking protective elements.

The major impact of the AD duty occurs in its effect on international trading volumes and on the real exchange rates. The optimal dumping margin remains the same at .50. Country *B*'s export of *T1* to country *A* falls over 27% relative to its initial level, while exports to the rest of the world rise from zero to 9.7 units. Country *B*'s imports from country *A* also fall by over 27%, while imports from the rest of the world rise to 12 units. Country *B*'s real exchange rate with *A* appreciates by 19.4% relative to the fair-trade equilibrium. This indicates that country *B*'s purchasing power is enhanced relative to that of country *A*. Consumer prices of *T1* in *B* rise by 20.3%, just as in the case of dumping alone, while consumption of *T1* there falls 15.5%.

In the dumping country, profits per firm fall in NT *numeraire* after the Type I duty, but remain 12.8% above the fair-trade equilibrium level. The quantity of *T1* produced falls slightly relative to the dumping case. GNP falls slightly, and welfare improves slightly, relative to the case of dumping alone. The AD duty will thus not discourage the profit-maximizing producer, but will impose a loss on country *B* through the terms-of-trade deterioration. In the importing country, the AD duty provides some support to *T1* producers: profits per firm rise slightly, as do output and employment, when compared to the dumping equilibrium. Despite the duty, the consumer prices of *T1* in

*NT numeraire* fall relative to the dumping case due to the real appreciation of the country-*A* exchange rate. There is also evidence of the Stolper-Samuelson effect, as the tariff on imports lowers the return to the abundant factor *K*. The net effect on welfare of the AD duty is negative, with welfare falling below that of the initial equilibrium and *a fortiori* below that of the dumping scenario.

The general-equilibrium effects of dumping and AD duties are evident in the evolution of the other tradeable good market. Dumping alone led to an increase in *T2* output in the dumping country and a fall in the importing country in response to substitution away from or into *T1*. Trade in *T2* fell relative to the non-dumping case because of the lower value of *T1* exports. When the AD duty is introduced the major loser is the *T2* sector in country *A*; output falls mainly because of the fall in exports to country *B*. The government income from the AD duty is rebated to consumers, and is sizeable at 3.4% of GNP.

#### IV. Examination of Null and Alternative Hypotheses

Our null hypothesis states that dumping *cum* AD duty returns the world economy to the predumping equilibrium. This is examined relative to the alternative hypothesis that the AD duty is a mere camouflage for a protective duty in its effects on the importing and exporting economies and does not eliminate the distortions due to dumping. In the final scenario documented in Table 3 we consider the impact of a 50% tariff in the absence of pre-existent dumping. Given the existence of a large third region prepared to provide the traded goods at the fair-trade terms of trade, it is not surprising that such a tariff by country *A* on country *B*'s goods has no effect on the two countries' domestic economies. Its only effect is to greatly stimulate trade with the rest of the world, with all trade between *A* and *B* replaced by trade with the rest of the world. The tariff thus collects no revenue, but does divert trade to the third market.

The null hypothesis holds for the case of an anticipated prompt and complete AD duty. As we noted in the text, the equilibrium resulting from market segmentation and a credible AD duty is identical to that of fair trade in this model.



In the case of sluggish or uncertain AD duties examination of the third column of Table 3 indicates that the null hypothesis does not hold. The dumping/AD duty scenario maintains large deviations in a broad array of variables from their values in the non-segmented trading equilibrium. The AD duty cannot affect the terms of trade, and has less impact on the real exchange rate, but nevertheless worsens in most cases the swings in variables away from their trading equilibrium.

The alternative hypothesis that an AD duty is simply a targeted protective tariff does not help to explain the domestic distortions in countries *A* and *B* in the dumping/AD duty equilibrium, but its evidence of trade rerouting does provide an explanation for the rapid growth in trade with the rest of the world. The observed dumping/Type I AD duty equilibrium is thus marked by characteristics both of protection and of the dumping margin maintained by the exporting country.

We reiterate the lessons of this hypothesis test: There are large gains for the two trading economies in the move from autarky to fair trade. Dumping reduces joint welfare, although the importing country wins big and the dumping country loses big. Imposition of the Type I AD duty brings about a still further fall in joint welfare, with the importing country losing from its AD duty imposition while the dumping country gains. The rationale for dumping is evident in the changes in profits of *T1*-producers in the two countries. Fair trade leads to an improvement in profits in country *B* relative to autarky, and to a precipitous decline in profits in country *A*. Dumping further improves firm-level profits in country *B*, while the imposition of AD duties has a slight negative impact there. Country-*A* profits are little affected by either of these innovations.

These changes in commercial policy have a large impact on the volume and pattern of trade. Fair trade brings about a large expansion in exports of *T1* by country *B* to country *A*, while (by construction) exports to the rest of the world remain at zero. The market segmentation that leads to dumping increases the volume of trade in *T1*, and also opens up some shipment to the rest of the world. Imposition of the AD duty leads to a large shift in the pattern of trade, with much more exported to the rest of the world, and a much smaller effect on export volume.

## V. An Extension: The Impact of Trade on Market Structure

The preceding results were predicated upon a fixed number of firms in each economy. In the absence of government restrictions to entry, this rigidity would not in general hold, especially in the presence of super-normal profits in the *T1* sector. An alternative assumption would be to let entry occur until those profits were eliminated, and we investigate that possibility in this section.

The first variant we explore is the possibility that the number of firms in the dumping country is fixed while the number in the importing country is not. In the short run trade and *a fortiori* dumping should lead to losses by the firms in the importing country; in the longer run the number of firms should shrink to reflect the new realities. As the first panel of Table 4 illustrates, the trading equilibrium leads to a marginal shrinkage of the number of firms in country *A* from the autarkic 2 to 1.66. Subsequent introduction of dumping, AD duties and equivalent tariffs have very small effects. The impact on the variables discussed in the previous section is also quite small, with welfare rising slightly in this long-run equilibrium as fewer fixed costs are incurred.

A second simulation illustrates the importance of government restrictions

**Table 4**  
**Dumping, AD Duties and Market Structure**  
 (Number of Firms Such That  $\pi_{ij} = 0$ )

For given structure in dumping country ( $n_h = 2$ ):

	$n_x$
Trading Equilibrium	3.66
Dumping Equilibrium	3.68
Dumping/AD Duty Equilibrium	3.68
Equivalent Tariff Equilibrium	3.66

Variable Market Structure in Both Countries:

	$n_x$	$n_h$
Trading Equilibrium	3.67	6.50

on entry into the *T1* sector in country *B*. The fixed costs of production in the *T1* sector serve as a barrier to entry in both countries; however, they are not the binding barrier in country *B* in the preceding simulations. If entry is allowed to bid profits to zero, the market structure changes markedly: in place of the 2 firms in country *B* and 2 in country *A*, the market supports 6.5 firms in country *B* and 3.67 firms in country *A*.

This change in market structure has an ambiguous effect on welfare. The increase in the number of firms narrows the wedge between price and marginal cost in *T1* production, and thus lowers the efficiency loss. However, the increase in the number of firms leads to an increase in outlays for fixed costs; as these do not directly increase consumption they reduce welfare. In the scenarios with  $n_h = 2$ , the output of *T1* per firm was 34.47 in country *B*; with free entry and  $n_h = 6.5$ , the output per firm becomes 11.67. Welfare in country *B* falls by 4.55%, while welfare in country *A* rises by 1.23% through the fall in *T1* prices due to competition.

There are two important conclusions we draw from these results. First, even if country *B* maintains the trade barriers that segmented the two markets in the previous example there will be less dumping after firm entry is allowed. The difference in perceived trade elasticities has shifted and has lessened dumping's profitability. Second, free entry is an expensive way to eliminate dumping. The fixed costs incurred lead to an unnecessary fall in welfare.

## VI. Conclusions

We have indicated both in analytical form and through simulations the impact of dumping behavior and AD duty retaliation on the exporting and importing country. We draw the following conclusions:

- the credible threat to impose anti-dumping (AD) duties promptly and in amount equal to the dumping margin can dissuade exporting firms from undertaking dumping activity. Observance of dumping and imposition of AD duties indicates, however, that the duties have failed at that task.
- imposition of AD duties does not have the impact often assigned to it, *i.e.* to offset completely the price impact of dumping and return the world economy to the pre-dumping equilibrium. Rather, when imposed they act

more as protective policies to insulate the import-competing sector from competition and as optimal tariffs to improve the purchasing power of all residents of the importing country. They do not end the dumping because they do not remedy the root cause: the difference in perceived price elasticity of demand in the two markets and the market segmentation.

- although dumping is undertaken by private firms, it cannot occur without the cooperation of the exporter government. Both segmentation of domestic from foreign markets and restrictions on entry of firms are necessary to assure the profitability of dumping. The former can be guaranteed through trade restrictions on the re-import of the dumped good, while the latter may be a component of industrial policy. Removal of these preconditions will eliminate dumping.

Our conclusions are drawn from the theoretical and simulation results of this paper, and as such are model-specific. We have performed sensitivity analysis with important parameters and obtained qualitatively identical results, but encourage further work to establish their generality. Allegations of dumping and imposition of anti-dumping duties have not diminished in recent years and it is important to recognize their true general-equilibrium implications as their use becomes widespread.

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