

Market Size and Antidumping in Duopolistic Competition

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Abstract

The existence of Antidumping Policies provides an incentive for firms to strategically moderate their behaviour so as to influence the antidumping duty levied on them or their competitors. This paper examines the outcomes of such behaviour in a two country two firm world where firms are identical, except for location, and countries differ only in market size. We find that a range of equilibria are possible, depending on the difference in market size.

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1 Introduction

While trade barriers such as tariffs and quotas have been considerably reduced under the role of GATT/WTO, antidumping (AD) actions, first introduced by Canada in 1904, are threatening to become the most important trade restricting device. A product is considered as being dumped "...if the export price...is less than the comparable price...for consumption in the exporting country" (Article 2.1 WTO AntiDumping Agreement). Most studies

view dumping as a sign of price discrimination across national markets, and that is the approach we take here. Our main interest is in the incentives that the existence of an AD Law provides for strategic behaviour on the part of oligopolistic firms selling in each others' segmented national markets.

In this paper we consider a world composed of two country markets, with one firm located in each. Both firms sell in both markets. The countries differ in terms of size, and markets are segmented. In the free trade equilibrium the larger country has the higher price and the firm located in that country "dumps" on the other market. We then consider a two period version of the model, and suppose that the smaller country has in place an Antidumping (AD) law under which dumping in the first period would result in an AD duty imposed in the second, equal to the dumping margin in the first period.

The existence of the AD law provides an incentive for both firms to act strategically in the first period. The dumper will act so as to reduce the duty it faces in the second period. The other firm will act so as to increase the duty faced by its rival. The equilibrium outcome of these strategic interactions is shown to depend on the difference in market sizes.

In some jurisdictions, a firm found to be dumping may avoid an AD duty if it agrees to sell at the same price in the two markets henceforth. We also determine the range of market size differences over which such a "price undertaking" would be preferred to an AD duty by the dumping firm.

The remainder of this paper is structured as follows. Section 2 reviews the related literature. Section 3 sets up the model where AD policy is absent, solves for the equilibrium outcomes and identifies the conditions under which one firm dumps in the other country. In section 4, we incorporate AD policy duty and show how this influences the strategic actions of the firms and equilibrium outcomes when the only policy instrument is the AD duty. The following section allows for price negotiation. Section 6 provides a summary and conclusions.

2 Related Literature (Incomplete)

While Viner's (1923) view of dumping as price discrimination between national markets has been followed by the majority of authors (Zarnic, 2002), other (complementary) explanations have been offered (see e.g. Ethier (1982), Davies and McGuinness (1982) and Anderson (1993)) Our focus is on price discrimination due to differences in market size. Where this happens, an

industry in the country where the price is lower, i.e. where dumping takes place could initiate an AD case by filing an AD petition against the dumping firm. The procedure for investigating the case is divided into two parts. Firstly, the dumping margin (in our case the price difference between two countries) is calculated. Secondly, where the dumping margin is sufficiently high, evidence that dumping causes material injury to the domestic industry is sought. Both dumping and material injury must be found before an AD action can be taken. Since our interest is in the incentives for strategic actions in the markets by the firms involved, we minimise the administrative aspects by assuming that if there is a difference in the prices at which a product is sold in the two markets, dumping will be found in the lower priced market, and, if the firm in that market chooses to file an AD petition, material injury will also be found.

If dumping and material injury are found, an AD duty, usually equal to the dumping margin, can be imposed on each unit of imports from the dumping firm. However, the government may not levy a duty but end the case with some kind of official agreement. For example, in the past the dumping firm may agree to meet a negotiated price (price undertaking) or limit the amount of exports (voluntary export restraint). Anderson (1992) shows that if the export volume permitted under the VER is a proportion of the current sales, allowing a VER would stimulate the foreign firm to dump even further. However, the implementation of voluntary export restraint is now inconsistent with the WTO Agreement. Below we therefore focus on AD actions in the form of AD duty or price negotiation.

Previous studies investigating the effects of AD Laws on firms incentives and actions have included Webb (1992), Reitzes (1993), Veugelers and Vandebussche (1998) and Pauwels et al. (2001). That such policies may provide an incentive for foreign direct investment has been noted and examined by Haaland and Wooton (1998), Blonigen (1998) and Vandebussche et al. (1999). The conditions under which the rival firms prefer one or other of the alternative outcomes (i.e. AD duty or price undertaking) has been considered by Prusa (1992), Gupta (1999) and Gupta and Panagariya (1998).

3 Free Trade

In this section we set up a very simple model, designed to highlight the implications of market size differences for the equilibrium outcomes. Here we

consider the free trade equilibrium, while in later sections we allow for an AD Law. Let there be two countries, home and foreign (H and F). Each country has one firm, both firms produce a homogeneous product at zero production costs and supply both markets. The two markets are segmented and there are no transport costs. The firms engage in Cournot competition. Assume the demand functions for the home and foreign country are, respectively

$$D = A - p; D^* = A^* - p^* \quad (1)$$

where D , p and A denote home demand, price and market size respectively, and $*$ indicates the corresponding variables for the foreign country. If we let $x; x^*$ denote the home firm's sales in the home and foreign markets, and $y; y^*$ the corresponding sales of the foreign firm, their respective profits are

$$\pi = px + p^*x^* \quad \text{and} \quad \pi^* = py + p^*y^*$$

Maximising profits under the Cournot assumptions yields first order conditions and equilibrium outcomes

$$\frac{\partial \pi}{\partial x} = p - x; \frac{\partial \pi}{\partial x^*} = p^* - x^*; \frac{\partial \pi^*}{\partial y} = p - y; \frac{\partial \pi^*}{\partial y^*} = p^* - y^* \quad (2)$$

$$x = y = \frac{A}{3}; x^* = y^* = \frac{A^*}{3}; p = \frac{A}{3}; p^* = \frac{A^*}{3} \quad (3)$$

$$\pi = \pi^* = \frac{A^2}{3} + \frac{A^*{}^2}{3}; CS = \frac{1}{2} \frac{2A^2}{3}; CS^* = \frac{1}{2} \frac{2A^*{}^2}{3} \quad (4)$$

Both firms sell the same amount in each market (but more in the larger market) and earn the same total profits. The price is higher in the larger market, which generates the possibility that the firm from the larger market could be subject to a claim of dumping in the smaller market. The dumping margin (in this case the price difference) will depend on the difference in market size (i.e. $p - p^* = \frac{A - A^*}{3}$).

4 Dumping

Now consider a two period, present (1) and future (2), version of this model. For simplicity we assume that the demand functions are as above in both

periods, and that agents do not discount the future. Without loss of generality we assume that the home market is larger (i.e. $A > A^*$) and that the foreign country has in place AD Legislation which provides that if the foreign firm files an AD petition and the home firm is found to have dumped in the present (period 1) it will be subject to a tax on its future (period 2) sales in the foreign market equal to the dumping margin (price difference) in the present. It will always be in the interests of the foreign firm to file such a petition if dumping has occurred in the first period. If the home firm were to ignore this threat and to continue to act as above it would be subject to an antidumping duty of $t = \frac{A - A^*}{3}$ in the future. Given that the home firm recognises that it is able to influence period 1 prices in the two markets, there are essentially four types of response that it can make to the threat of antidumping action - it may ignore it; it may moderate its sales so as to equalise prices in the two markets (at least in the present period); it may moderate its present sales so as to reduce (but not remove) the dumping margin; or it may withdraw from the foreign market entirely in the future (or in the present). We now examine the circumstances (i.e. ranges of market size differences) for which each of these would be the preferred option. Two points are worth emphasising. First, the home firm can adjust its sales in both markets in order to reduce or remove the dumping margin. Second, the foreign firm can also influence the dumping margin through its present period sales in both markets and can be expected to strategically modify its behaviour accordingly. The strategic actions of both firms are important in determining the range of possible outcomes.

In the second period, firms maximise their profits, with the home firm subject to antidumping duty t . Hence

$$\text{Home Firm} \quad \max_{x_2; x_2^*} \frac{1}{2} \pi_2 = p_2 x_2 + [p_2^* - t] x_2^* \quad (5)$$

$$\text{Foreign Firm} \quad \max_{y_2; y_2^*} \frac{1}{2} \pi_2^* = p_2 y_2 + p_2^* y_2^* \quad (6)$$

Where $t = \max\{0; p_1 - p_1^*\}$. The equilibrium outcomes are

$$x_2 = y_2 = \frac{A}{3}; x_2^* = \frac{A^* - 2t}{3}; y_2^* = \frac{A^* + t}{3}; p_2 = \frac{A}{3}; p_2^* = \frac{A^* + t}{3} \quad (7)$$

$$\frac{1}{2} \pi_2 = \frac{A^2}{3} + \frac{A^* - 2t}{3} \frac{A^* + t}{3}; \frac{1}{2} \pi_2^* = \frac{A^2}{3} + \frac{A^* + t}{3} \frac{A^* + t}{3} \quad (8)$$

Home firm exports are reduced (but are positive as long as $t < \frac{A^a}{2}$) and the foreign price is increased by the antidumping action. Home firm profits fall, foreign firm profits increase. Both firms understand these second period consequences at the time that they determine their first period sales.

In this case the outcomes in the two periods are linked by the antidumping duty, and we must explicitly consider this link in analysing firm strategies in the first period.

$$\text{Home Firm} \quad \max_{x_1; x_1^a} \mathcal{V}_1 = p_1 x_1 + p_1^a x_1^a + \mathcal{V}_2(p_1; p_1^a) \quad (9)$$

$$\text{subject to} \quad p_1 \geq p_1^a \quad \lambda \geq 0$$

$$\text{Foreign Firm} \quad \max_{y_1; y_1^a} \mathcal{V}_1^a = p_1 y_1 + p_1^a y_1^a + \mathcal{V}_2^a(p_1; p_1^a) \quad (10)$$

where $\mathcal{V}_2(\cdot)$ and $\mathcal{V}_2^a(\cdot)$ are as in (8). The first order conditions reveal the extent to which the two firms adjust outputs in the first period so as to manipulate the antidumping penalty in the second. Thus

$$\frac{\partial \mathcal{V}_1}{\partial x_1} = p_1 - x_1 + \frac{4}{9} f A^a - 2[p_1 - p_1^a] g - \lambda \quad (11)$$

$$\frac{\partial \mathcal{V}_1}{\partial x_1^a} = p_1^a - x_1^a + \frac{4}{9} f A^a - 2[p_1 - p_1^a] g + \lambda \quad (12)$$

$$\frac{\partial \mathcal{V}_1^a}{\partial y_1} = p_1 - y_1 + \frac{2}{9} f A^a + [p_1 - p_1^a] g \quad (13)$$

$$\frac{\partial \mathcal{V}_1^a}{\partial y_1^a} = p_1^a - y_1^a + \frac{2}{9} f A^a + [p_1 - p_1^a] g \quad (14)$$

where $x_1; x_1^a; y_1; y_1^a; \lambda \geq 0$, and λ is the Lagrange multiplier for the price inequality constraint, implying that $\lambda [p_1 - p_1^a] = 0$: Compared with free trade, the home firm tends to switch sales from the foreign to the home market, thereby reducing the antidumping duty that it faces next period. The foreign firm does the opposite, thereby increasing the future penalty faced by its competitor.

4.1 Only the Dumping Firm Behaves Strategically

It will assist in the interpretation of our results, if we first solve a more restricted model, where only the home firm acts strategically so as to influence

the dumping margin. In this case the home firm's optimization problem and corresponding first order conditions are as in (9) above, But the foreign firm's optimisation function and first order conditions are now

$$\max_{y_1; y_1^a} \pi_1^a = p_1 y_1 + p_1^a y_1^a \quad (15)$$

$$\frac{\partial \pi_1^a}{\partial y_1} = p_1 - c_1 \quad (16)$$

$$\frac{\partial \pi_1^a}{\partial y_1^a} = p_1^a - c_1^a \quad (17)$$

Solving (11), (12), (16) and (17) yields three potential types of equilibrium outcomes, depending on the difference in market size. We consider each in turn.

4.1.1 Temporary Market Integration:

In this case $p_1 = p_1^a = p_i$ and the equilibrium solutions are

$$x_1 = \frac{2A - A^a}{3}; x_1^a = \frac{2A^a - A}{3}; y_1 = y_1^a = \frac{A + A^a}{6} = p_i \quad (18)$$

$$\tau = \frac{17A^a - 9A}{18} \quad (19)$$

The second period outcomes are as in free trade. For this to be a feasible equilibrium we require that all outputs, prices and τ be non-negative, which holds if $A^a \geq A - \frac{17}{9}A^a$: At the upper bound of this range $\tau = 0$. Compared with free trade, the total sales of the two firms are unchanged, with the home (foreign) firm selling more (less) in the home market and less (more) in the foreign, but the net result is that total sales rise in the home market and fall in the foreign so that the prices are equalised.

$$\begin{aligned} \Phi[x_1 + x_1^a] = \Phi[y_1 + y_1^a] = 0; \Phi x_1 = -\Phi x_1^a &= \frac{A - A^a}{3} \\ \Phi y_1 = -\Phi y_1^a = \frac{A - A^a}{6}; \Phi[x_1 + y_1] = -\Phi[x_1^a + y_1^a] &= \frac{A - A^a}{6} \end{aligned}$$

The profits of the home (foreign) firm rise (fall) in the home market and fall (rise) in the foreign, but the net change is a fall in first period profits, and

therefore a fall in overall profits, for both firms. Consumer surplus rises in the home country and falls in the foreign, following the equalisation of prices. When these terms are combined we find that home welfare rises, but foreign welfare falls.

$$\begin{aligned} \Phi_{\frac{1}{4}} &= \Phi_{\frac{1}{4}}^* = \frac{[A_i - A^*]^2}{18} \\ \Phi_{CS} &= \frac{1}{2} \frac{[A_i - A^*]}{6} \frac{[9A_i - A^*]}{6} > 0; \Phi_{CS}^* = \frac{1}{2} \frac{[A_i - A^*]}{6} \frac{[9A^* - A_i]}{6} < 0 \\ \Phi_W &= \frac{[A_i - A^*]}{6} \frac{[5A_i + 3A^*]}{12} > 0; \Phi_W^* = \frac{[A_i - A^*]}{6} \frac{[3A_i + 5A^*]}{12} < 0 \end{aligned}$$

Thus if the difference in market size is small, the threat of an antidumping duty in the second period is sufficient for the potential dumper to adjust its sales so that prices are equalised in the first period and therefore no dumping is found and no duty imposed in the second period. The result is that both firms' profits fall, and home consumers gain and foreign consumers lose. Overall, there is a net gain to the larger country and a net loss to the smaller. The country that threatens the antidumping action is actually worse off, both in terms of profit and consumer surplus. One can see that it is in the interests of large countries to encourage their smaller trading partners to adopt antidumping legislation in such circumstances.

4.1.2 Moderated Dumping.

Where the difference in market sizes is larger the dumping firm moderates its behaviour but not to the point of full price equalisation. Now $p_1 > p_1^*$ and $\tau = 0$, and the equilibrium solutions are

$$x_1 = \frac{40A_i - 5A^*}{33}; x_1^* = \frac{16A_i - 29A^*}{33}; x_2^* = 3 \frac{[5A^* - A_i]}{11} \quad (20)$$

$$p_1 = \frac{19A_i - 20A^*}{33}; p_1^* = \frac{31A^* - 8A_i}{33}; p_1 > p_1^* = \frac{9A_i - 17A^*}{11} \quad (21)$$

$$y_1 = \frac{19A_i - 20A^*}{33}; y_1^* = \frac{31A^* - 8A_i}{33}; y_2^* = \frac{3A_i - 2A^*}{11} \quad (22)$$

The range of demand differences for which this is a feasible equilibrium is $\frac{17}{9}A^a < A < \frac{5}{2}A^a$, with $p_1 = p_1^a$ at the lower bound and $x_2^a = 0$ at the upper bound. In this case an antidumping duty is imposed on the home firm's sales in the foreign market in the second period, and as a consequence total sales in that market fall. Again the total first period sales of the two firms are unchanged, but the home firm sells more in the home market and less in the foreign, and the foreign firm does the opposite. Total sales in the home market rise, while total sales in the foreign market fall, but not by enough to equalise prices.

$$\begin{aligned} \Phi[x_2^a + y_2^a] &= i \frac{[9A - 17A^a]}{33} < 0; \Phi[x_1 + x_1^a] = \Phi[y_1 + y_1^a] = 0 \\ \Phi x_1 &= i \Phi x_1^a = \frac{8[5A^a - 2A]}{33}; \Phi y_1 = i \Phi y_1^a = i \frac{4[5A^a - 2A]}{33} \\ \Phi[x_1 + y_1] &= i \Phi[x_1^a + y_1^a] = \frac{4[5A^a - 2A]}{33} \end{aligned}$$

As in the case of temporary market integration, the home firm's first period profits rise in the home market, fall in the foreign market and fall overall. Its second period profits in the foreign market are adversely affected by the antidumping duty, and thus its profits over the two periods decline. The foreign firm's first period profits decline in the home market, rise in the foreign market and decline overall. Its second period profits increase. The change in the foreign firm's total profits switches sign within this range. Early on, the first period prices are almost equalised and the antidumping duty imposed on its rival in the second period is quite small. Thus foreign firm profits fall. However, towards the end of the range, first period prices, and hence profits, are almost unchanged from free trade, while the antidumping duty levied in the second period is quite large. The net result is an increase in the foreign firm's profits.

$$\begin{aligned} \Phi \pi_1 &< 0; \Phi \pi_2 < 0; \Phi \pi < 0; \Phi \pi_1^a < 0; \Phi \pi_2^a > 0 \\ \Phi \pi^a & \text{ T } 0 \text{ as } A \text{ T } 2:14A^a \end{aligned}$$

Consumer surplus increases in the home country in the first period, but the gain is small later in the range, as the home market price is very similar to free trade. When the change in home firm profits and home consumer surplus are combined, the net result is a gain in home welfare early in the range, and a net loss of home welfare later in the range. Foreign consumer

surplus declines in both periods, but foreign welfare now consists of consumer surplus plus profits plus antidumping revenues (R^*). The latter is zero at each end of the range, and peaks when $A = 2:19A^*$. When these terms are combined we find a foreign welfare loss early in the range becomes a foreign welfare gain towards the end.

$$\Phi CS > 0; \Phi CS^* < 0; R^* = 3 \frac{[9A - 17A^*][5A^* - 2A]}{11} > 0$$

$$\Phi W > 0 \text{ as } A > 2:27A^*; \Phi W^* < 0 \text{ as } A > 2:35A^*$$

4.1.3 Unconstrained Dumping

However, when the difference in market sizes becomes sufficiently large, the outcome has the first period equilibrium as in free trade and the home firm does not sell in the foreign market in the second period, because the antidumping duty is prohibitive. The second period equilibrium solutions are then as in free trade in the home market and a foreign firm monopoly in the foreign market.

$$x_2 = y_2 = p_2 = \frac{A}{3}; x_2^* = 0; y_2^* = p_2^* = \frac{A^*}{2} \quad (23)$$

The home firm's profits fall, the foreign firm's profits rise. Home consumer surplus is unchanged, foreign consumer surplus falls. There is no antidumping revenue. Home welfare falls, foreign welfare rises.

$$\Phi CS = 0; \Phi W = \Phi W^* = -\frac{1}{3} \left[\frac{A^*}{3} \right]^2 < 0;$$

$$\Phi W^* = 5 \left[\frac{A^*}{6} \right]^2 > 0; \Phi CS^* = -\frac{1}{2} \left[\frac{A^*}{6} \right]^2 < 0; \Phi W^* = \frac{3}{2} \left[\frac{A^*}{6} \right]^2 > 0$$

These price outcomes are illustrated, in Figure 1 (not included). If the difference in market size is sufficiently small ($A < \frac{17}{9}A^*$), then the home firm adjusts its sales in the two markets so as to equalise product prices, thereby avoiding the antidumping duty in the second period. Where the market size difference is slightly larger ($\frac{17}{9}A^* < A < \frac{5}{2}A^*$), the home firm adjusts its sales so as to moderate the duty it faces in the second period. For larger market size differences, the home firm finds it optimal to abandon the foreign market in the second period as the antidumping duty is prohibitive.

These are the outcomes of the strategic actions the home firm would undertake were the foreign firm to remain a passive Cournot competitor. The threat of the antidumping duty will remove or moderate dumping, except where the difference in market sizes is large. The dumping firm is worse off and the foreign firm is only better off if the difference in market sizes is large enough that moderation of the price difference is slight. But given that the foreign firm also has an incentive to act strategically, we now return to the more general case whose first order conditions are (11) to (14) above.

4.2 Both Firms Behave Strategically

As one might expect, the solution to the general case includes the same types of outcomes as just considered, but others as well, and the ranges of applicability differ.

4.2.1 Temporary Market Integration

For small differences in market size, the equilibrium has $p_1 = p_1^* = p_i$ as before, with

$$\begin{aligned} x_1 &= \frac{6A - A^*}{9}; x_1^* = \frac{4A^* - 3A}{9}; y_1 = \frac{3A - A^*}{18}; y_1^* = \frac{3A + 7A^*}{18} \\ p_i &= \frac{A + A^*}{6}; \tau = \frac{13A^* - 9A}{18} \end{aligned} \quad (24)$$

The second period outcomes are as in free trade. When both firms act strategically, the range of demand differences for which this is a feasible equilibrium is $A^* < A - \frac{4}{3}A^*$, with $x_1^* = 0$ at the upper bound. In the first period total sales of each of the two firms are unchanged from free trade, but the home firm sells more in its own market and less in the foreign market in order to reduce the dumping margin, while the foreign firm does the opposite. Note that these sales adjustments are larger than they would be if only the home firm acted strategically, but the net result is the same - increased sales in the home market (of $\frac{A - A^*}{6}$) and reduced sales in the foreign market of the same amount, so that prices are equalised.

$$\begin{aligned} \Phi[x_1 + x_1^*] &= \Phi[y_1 + y_1^*] = 0; \Phi[x_1 + y_1] = -\Phi[x_1^* + y_1^*] = \frac{A - A^*}{6} \\ \Phi x_1 &= -\Phi x_1^* = \frac{3A - A^*}{9}; \Phi y_1 = -\Phi y_1^* = -\frac{3A + A^*}{18}; \end{aligned}$$

Again, the home (foreign) firm's profits increase (fall) in the home market, but they decline (rise) in the foreign market. Overall both firms' first period profits decline relative to free trade, by the same amount. Since free trade remains the equilibrium in the second period, both firms are worse off. The change in first period consumer surplus in each country depends on what happens to total sales in its market. Thus consumer surplus rises in the home country and falls in the foreign. When changes in profits and consumer surplus are combined we find that home welfare rises and foreign welfare falls. All of these changes are identical to those when the strategic actions of the home firm alone generate temporary market integration.

$$\begin{aligned}\Phi \pi_1 &= \Phi \pi_1^* = \frac{[A - A^*]^2}{18} < 0; \\ \Phi CS &= \frac{1}{2} \frac{[A - A^*]}{6} \frac{[9A - A^*]}{6} > 0; \Phi CS^* = \frac{1}{2} \frac{[A - A^*]}{6} \frac{[9A^* - A]}{6} < 0 \\ \Phi W &= \frac{[A - A^*]}{6} \frac{[5A + 3A^*]}{12} > 0; \Phi W^* = \frac{[A - A^*]}{6} \frac{[3A + 5A^*]}{12} < 0\end{aligned}$$

Note that while the outcomes in this case are the same (except for the distribution of firms' sales in the first period) as they would be if only the home firm acted strategically, the range of differences in market sizes for which temporary market integration is the equilibrium outcome is much narrower (i.e. $A^* < A - \frac{4}{3}A^*$ instead of $A^* < A - \frac{17}{9}A^*$). The upper boundary is now defined by the non-negativity constraint on the sales of the home firm in the foreign market (i.e. $x_1^* \geq 0$). As we shall see, there is a range of market size differences for which the home firm abandons the foreign market in the first period.

4.2.2 Moderated Dumping.

When the difference in market sizes is larger, the equilibrium solutions have $p_1 > p_1^*$ and $x_2 = 0$, and:

$$x_1 = \frac{4A^* - A}{3}; x_1^* = \frac{2A - 3A^*}{3}; y_1 = \frac{11A - 12A^*}{21}; y_1^* = \frac{19A^* - 4A}{21} \quad (25)$$

$$p_1 = \frac{17A - 16A^*}{21}; p_1^* = \frac{23A^* - 10A}{21}; p_1 > p_1^* = \frac{9A - 13A^*}{7} \quad (26)$$

$$x_2 = y_2 = p_2 = \frac{A}{3}; x_2^* = \frac{11A^* - 6A}{7}; y_2^* = p_2^* = \frac{3A - 2A^*}{7} \quad (27)$$

This yields a feasible equilibrium as long as $\frac{3}{2}A^a < A < \frac{11}{6}A^a$, with $x_1^a = 0$ at the lower bound, and $x_2^a = 0$ at the upper bound. Again the total sales of each firm are unchanged in the first period, but the home firm sells more in the home market and less in the foreign market, while the foreign firm does the opposite. Interestingly, the signs of the changes in total sales in these two markets switch during this range. When $\frac{3}{2}A^a < A < \frac{8}{5}A^a$, total sales in the home (foreign) market are higher (lower) than in free trade, and the dumping margin is reduced by the strategic actions of the two firms. But when $\frac{8}{5}A^a < A < \frac{11}{6}A^a$, this outcome is reversed. Total sales in the home (foreign) market are smaller (greater) than in free trade, implying an increased dumping margin as a result of their combined strategic actions. For a (small) range of differences in market size, the AD Law leads to a larger dumping margin than would occur in its absence.

$$\begin{aligned} \Phi[x_1 + x_1^a] &= \Phi[y_1 + y_1^a] = 0; \Phi(x_1 + y_1) = \Phi(x_1^a + y_1^a) = \frac{16A^a - 10A}{21} \\ \Phi x_1 &= \Phi x_1^a = \frac{4A^a - 2A}{3} > 0; \Phi y_1 = \Phi y_1^a = \frac{4A - 12A^a}{21} < 0 \\ \Phi[x_2^a + y_2^a] &= \frac{13A^a - 9A}{7} < 0 \end{aligned}$$

These changes in outputs and prices mean that the determination of the changes in profits in the first period is less straightforward than under temporary market integration. The home firm sells more in the home market, where the price may rise or fall. One can show that the home firm's profits in the home market rise. Conversely, the home firm's sales in the foreign market fall, and the price there may rise or fall, but the net result is a fall in home firm profits in the foreign market. Combining these two, we find that home firm profits increase in the first period. Unsurprisingly, home firm profits in the second period fall relative to free trade as a result of the antidumping duty. Combining the two we find that home firm profits are reduced relative to free trade. For the foreign firm, its profits in the home market are smaller than in free trade, but its profits in the foreign market rise. The net result is a decline in foreign firm first period profits. However, again unsurprisingly, the foreign firm's profits in the second period increase. The net change in the foreign firm's profits depends on relative market sizes within the range, falling if $\frac{3}{2}A^a < A < 1.629A^a$ and rising if $1.629A^a < A < \frac{11}{6}A^a$.

$$\begin{aligned} \Phi \pi_1 &> 0; \Phi \pi_2 < 0; \Phi \pi < 0 \\ \Phi \pi_1^a &< 0; \Phi \pi_2^a > 0; \Phi \pi^a \geq 0 \text{ as } A \geq 1.629A^a \end{aligned}$$

The change in home and foreign consumer surplus in the first period depends on whether the price in the relevant market rises or falls. But foreign consumer surplus falls in the second period due to the price increase. The net result is a fall in foreign consumer surplus. Revenue from the antidumping duty is positive throughout the range except at the upper bound where the home firm's sales are zero. Revenue is at a maximum when $A = 1.64A^*$. In the home country, the profits of the home firm fall, while consumer surplus increases for small market size differences, and falls when this difference is relatively large. When these effects are combined we find that home welfare is higher (lower) when the market size differences are relatively small (large) in this range. The opposite is the case for the foreign country. There consumer surplus is lower and the foreign firm's profits rise (fall) when the market size difference is relatively large (small). When profits, consumer surplus and revenue are combined we find that foreign welfare rises (falls) when the market size difference is relatively large (small) in this range.

$$\begin{aligned} \Delta CS_1 & \geq 0 \text{ and } \Delta CS_1^* \leq 0 \text{ as } A \leq \frac{8}{5}A^*; \Delta CS_2^* < 0; \Delta CS^* < 0 \\ R^* & = \frac{[9A - 13A^*][11A^* - 6A]}{7} \\ \Delta W & \geq 0 \text{ as } A \leq 1.57A^*; \Delta W^* \leq 0 \text{ as } A \geq 1.62A^* \end{aligned}$$

4.2.3 Withdrawal in the first period.

Between temporary market integration and moderated dumping there is a range of market size differences (i.e. $\frac{4}{3}A^* < A < \frac{3}{2}A^*$) where the only equilibrium sees the home firm withdrawing from the foreign market in the first period. In that period we have the free trade quantities sold in the home market and a foreign firm monopoly in the foreign market. Free trade continues in both markets in the second period.

$$x_1 = y_1 = p_1 = \frac{A}{3}; x_1^* = 0; y_1^* = p_1^* = \frac{A^*}{2} \quad (28)$$

The other effects follow directly. The home firm's profits fall, the foreign firm's profits rise. Home consumer surplus is unchanged, foreign consumer surplus falls. There is no antidumping revenue. Home welfare falls, foreign welfare rises.

4.2.4 Unconstrained Dumping

If $A > \frac{11}{6}A^*$, then the first period will see unmoderated dumping by the home firm. The first period equilibrium will then be as in free trade. For the range $\frac{11}{6}A^* < A < \frac{5}{2}A^*$, the corresponding duty is not prohibitive, with

$$x_1 = y_1 = p_1 = \frac{A}{3}; x_1^* = y_1^* = p_1^* = \frac{A^*}{3}; p_1 - p_1^* = \frac{A - A^*}{3} \quad (29)$$

$$x_2 = y_2 = p_2 = \frac{A}{3}; x_2^* = \frac{5A^* - 2A}{9}; y_2^* = p_2^* = \frac{A + 2A^*}{9} \quad (30)$$

When $A > \frac{5}{2}A^*$ the home firm does not sell in the foreign market in the second period.

The effects of the strategic actions by both firms, in comparison with just those of the dumping firm, can be seen by comparing Figures 1 and 2 (not included). The general outcomes illustrated in Figure 2, show that for small differences in market size, the AD law results in full market integration. There is then a small range of market size differences where the only equilibrium has the home firm abandoning the foreign market in the first period. Market size differences greater than this result in "moderated" dumping over a range, followed by "exaggerated" dumping over another. The latter results in a higher dumping margin than would occur without the threat of AD action. For market size differences larger than this, the firms take no strategic actions, and eventually the home firm ceases to sell in the foreign market in the second period when the dumping margin becomes prohibitive.

5 Price Negotiation (Incomplete)

Rather than imposing a duty on imports from the dumping firm, the government of the dumped-upon country may negotiate with the dumping firm over that firm's selling price. This type of antidumping action has been used for EU antidumping cases. We maintain throughout the assumptions imposed in the previous sections, but now the home firm, if it dumps in the first period, may avoid the AD duty by undertaking to sell in the foreign market at the same price as it sells in the home market in the second period. The existence of this price undertaking option changes the strategic incentives of the firms in two important ways. First, it reduces the incentive for strategic actions by the two firms in the first period, as the penalty facing the dumping firm

is not affected by the dumping margin. Second, the foreign firm will find it optimal not to request an AD action if this makes it worse off than free trade in the second period. In contrast the foreign firm would always find it profitable to request an AD duty.

We begin by examining the second period equilibrium under the price undertaking. The home firm maximises profits subject to the constraint that $p_2 = p_2^*$, i.e.

$$\max_{x_2, x_2^*} p_2 x_2 + p_2^* x_2^* \quad (31)$$

$$\text{subject to } p_2 = p_2^*$$

For the foreign firm, the profit function is

$$\max_{y_2, y_2^*} \pi_2^* = p_2 y_2 + p_2^* y_2^* \quad (32)$$

The first order conditions yield

$$x_2 = p_2 - \lambda; x_2^* = p_2^* + \lambda; y_2 = p_2; y_2^* = p_2^*; p_2 = p_2^*$$

where λ is the Lagrange multiplier associated with the price undertaking constraint. These conditions can be solved for

$$\lambda = \frac{A - A^*}{2}; p_2 = p_2^* = y_2 = y_2^* = \frac{A + A^*}{6} \quad (33)$$

$$x_2 = \frac{2A - A^*}{3}; x_2^* = \frac{2A^* - A}{3}; \pi_2 = \pi_2^* = 2\left[\frac{A + A^*}{6}\right]^2 \quad (34)$$

This is a feasible solution (i.e. all outputs and prices are positive) as long as $A < 2A^*$. As expected, these outcomes are the same as for temporary market integration in the first period, except that the range of market size differences over which this is a feasible equilibrium is larger. Where a price undertaking is the anticipated second period outcome, the first period equilibrium will be as in free trade. The price undertaking is independent of the dumping margin in the first period.

Given our assumption that the second period is not discounted, the order of periods of free trade and market integration is immaterial, and hence the profits from temporary market integration followed by free trade, and free trade followed by temporary market integration are the same for both firms.

The price undertaking is also feasible over the range of temporary market withdrawal (i.e., $\frac{4}{3}A^w < A < \frac{3}{2}A^w$). Comparing profits in the two cases, one finds that

$$\frac{1}{4}P^U > \frac{1}{4}W = 2\left[\frac{A + A^w}{6}\right]^2 > \left[\frac{A}{3}\right]^2 > 0 \text{ as long as } A > \left[1 + \frac{p_w}{2}\right]A^w$$

So the price undertaking is preferred by the home firm. The price undertaking is feasible over the range of moderated dumping ($\frac{3}{2}A^w < A < \frac{11}{6}A^w$). Comparing profits under these regimes we find that

$$\frac{1}{4}M > \frac{1}{4}P^U \text{ as } A > 1.44A^w$$

so moderated dumping is the preferred option of the home firm over its range of feasibility. Finally one can show that, where it is feasible, the price undertaking is preferred to unmoderated dumping

$$\frac{1}{4}P^U > \frac{1}{4}UD = \left[\frac{A + A^w}{18}\right]\left[\frac{41A^w + 17A}{9}\right] > 0 \text{ as } A > 2.41A^w$$

However, the ex ante preferences of the dumping firm over the alternative penalties under a successful AD action will not necessarily provide an accurate indication of equilibrium outcomes in this case. As noted above, when the price undertaking is the likely outcome, the foreign firm will be worse off than in free trade in the second period, and hence will prefer not to initiate an AD action at all. Thus determining the equilibrium outcomes when a price undertaking or an AD duty are the two alternative outcomes from an AD action, requires us to work through the following steps. First, given AD is to be taken, to determine under what conditions the dumper prefers the duty versus the price undertaking. Second, given this information, to determine under what conditions the foreign firm will initiate an AD action. Third, with these possible second period outcomes in mind, to determine the optimal strategic behaviour of the two firms in the first period. [Yet To Be Done]

6 Conclusion (Incomplete)

This paper has examined the incentives for strategic action by duopolistic competitors generated by the existence of an AD Law in the smaller market. To do this we set up a simple model of two country markets, and two

...rms, where countries differ only in their market size (intercepts on a linear demand function), and ...rms differ only in their locations. If only the dumping ...rm acts strategically, the outcomes are straightforward. We have full market integration (price equalisation) if the differences in market sizes is small, moderated dumping if the market size difference is slightly larger, and unmoderated dumping which leads to a prohibitive antidumping duty for large market size differences.

If the non-dumping ...rm also acts strategically (to boost the duty imposed on its rival), these same equilibrium outcomes can arise, but over different ranges of market size differences. We find, in addition, an intermediate range of market size differences for which the only equilibrium outcome has the dumping ...rm abandoning exports in the ...rst period. For a range of market size differences moderated dumping turns into aggravated dumping, where the dumping margin is larger than it would be in free trade, due to the strategic actions of the other ...rm.

References

- [1] Anderson, J. E. (1992), "Domino Dumping I: Competitive Exporters", *American Economic Review*, Vol. 82, pp. 65-83.
- [2] Anderson, J. E. (1993), "Domino Dumping II: Antidumping", *Journal of International Economics*, Vol. 35, pp. 133-50.
- [3] Brander, J. and P. Krugman (1982), "A 'Reciprocal Dumping' Model of International Trade", *Journal of International Economics*, Vol. 15, pp. 313-21.
- [4] Davies, S. and A. McGuinness (1982), "Dumping at Less Than Marginal Cost", *Journal of International Economics*, Vol. 12, pp. 169-82.
- [5] Ethier, W. J. (1982), "Dumping", *Journal of Political Economy*, Vol. 90, pp. 481-506.
- [6] Gruenspecht, H. K. (1988), "Dumping and Dynamic Competition", *Journal of International Economics*, Vol. 25, pp. 225-48.
- [7] Gupta, P. (1999), "Why Do Firms Pay Antidumping Duty?", IMF Working Paper, Washington.

- [8] Haaland, J. I. and I. Wooton (1998), "Antidumping Jumping: Reciprocal Antidumping Law and Industrial Location", *Weltwirtschaftliches Archiv*, Vol. 134, No.2, 340-62.
- [9] Messerlin, P. A., and G. Reed (1995), "Antidumping Policies in the United States and the European Community", *The Economic Journal*, Vol. 105. pp. 1565-75.
- [10] Panagariya, A. and P. Gupta (1998), "Antidumping Duty Versus Price Negotiation", *The World Economy*, Vol. 21, No. 8, pp. 1003-19.
- [11] Pauwels, W., H. Vandenbussche, and M. Weverbergh (2001), "Strategic Behavior under European Antidumping Duties", *International Journal of the Economics of Business*, Vol. 8, No. 1, pp. 75-99.
- [12] Prusa, T. (1992), "Why Are So Many Antidumping Petitions Withdrawn?", *Journal of International Economics*, Vol. 33, pp. 1-20.
- [13] Reitzes, J. (1993), "Antidumping Policy", *International Economic Review*, Vol. 34, No. 4, pp. 745-63.
- [14] Staiger, R. W. and F. A. Wolak (1992), "The Effect of Domestic Antidumping Law in the Presence of Foreign Monopolist", *Journal of International Economics*, Vol. 32, pp. 265-87.
- [15] Vandenbussche, H., R. Veugelers, and R. Belderbos (1999), "Undertakings and Antidumping Jumping FDI in Europe", CEPR Discussion Paper No. 2320, London.
- [16] Veugelers, R. and H. Vandenbussche (1999), "European Anti-Dumping Policy and the Profitability of National and International Collusion", *European Economic Review*, Vol. 43, 1-28.
- [17] Viner, J. (1923), *Dumping: A Problem in International Trade*, University of Chicago Press, Chicago.
- [18] Webb, M. (1992), "The Ambiguous Consequences of Anti-Dumping Laws", *Economic Inquiry*, Vol. 30, 437-48.
- [19] Zarnic, Z. (2002), "Antidumping", paper written for Seminar in Aussenwirtschaft, Sommersemester 2002.