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The practice of dumping goods on foreign markets at prices grievously below those on domestic markets is of great concern to producers and policymakers in the receiving countries. Japan has been accused of dumping semi-conductors and electronic manufactures in the USA and Europe, the USA and Europe in turn have been accused by many LDCs of dumping agricultural products in the world market, while some NICs are alleged to have dumped textiles on Japan. At any given time, the GATT secretariat is inundated with complaints regarding alleged dumping.

It would appear from the theoretical literature on dumping that, provided retaliation does not take place, the countries perpetrating the 'evil' deed have everything to gain. In this paper, we shall focus on this issue and shall demonstrate that dumping may not be welfare-improving for the dumper. Indeed, it may be appropriate for the dumping country's government to ban the practice altogether. This is in contrast to what happens in practice; anti-dumping legislation is introduced invariably by the dumped-upon countries.

The theoretical literature on dumping has many strands. There is now a growing body of literature that analyzes the issue in the context of an international oligopoly model where international-market-share rivalry provides the key ingredient (see, for example, Brander and Krugman(1983), Brander and Spencer(1985) and Dixit(1988)). In this type of model, a country has every reason to complain about (government subsidy-induced) dumping by another, as the dumping country enhances its welfare at the expense of others.

There is another strand in the literature that is based upon monopoly models. Unlike the traditional treatment of the subject which treats dumping as an application of price discrimination theory (see Viner(1923)), some of the models in this area have the monopolist undertaking predatory dumping to discourage possible new entrants into the market (see, for example, Ethier(1982), Davies and McGuiness(1982) and Bernhardt(1984)). Once again, this is essentially a question of market share rivalry, and by dumping, the welfare of the country in which the monopolist is based must increase, simply because it would otherwise lose its monopoly power in the foreign market.

In their interesting paper, Davies and McGuiness(1982) - to be referred to as DM henceforth - have also shown that, even when market share is not at stake, the possibility of dumping products abroad by a monopolist can increase domestic welfare. In their model, the world market is perfectly competitive but uncertain while the domestic market is

monopolistic, sustained by protection. They introduced the further fascinating assumption that the average foreign price of exports is below the marginal cost of domestic production. Their result that these 'average loss-making exports' unambiguously increase domestic welfare under linearity of demand seems extremely surprising on first reflection. This result *inter alia* follows from another of their surprising results that the possibility of dumping below marginal cost on average creates a production incentive for the monopolist. Their model can be applied to a simplified analysis of the recent spate of agricultural product dumping by the European Community (EC) on the Soviet Union. The Soviet Union welcomes the cheap imports and EC agricultural producers are evidently happy to promote the practice. However, EC consumers have not been silent in their protests about this dumping, although the results of the DM paper would suggest that, under linearity of demand, there would be no reason for complaint. Our paper will attempt to remedy this apparent inconsistency between the theory and the facts.

Now dumping necessarily involves a price-discriminating monopolist exerting monopoly power in the domestic market. In the presence of this distortion, it is then not altogether surprising that the imposition of an additional 'distortion', in the form of dumping of average loss-making exports, can turn out to be welfare-improving. But if the government intervenes optimally to eliminate the first distortion, the welfare implications of dumping can change. In this paper, we shall take the uncertainty/monopoly analysis of DM as the benchmark. The questions that we set ourselves are these: Do private markets deliver the socially optimal degree of dumping? Is the practice of dumping always socially beneficial? With an optimal subsidy in place, will firms want to dump goods abroad?

From a social perspective, monopolies under-produce, and indeed dumping does encourage a greater amount of production. Now the question is whether this encouragement is excessive or inadequate. Our result here is that the standard monopoly distortion is not adequately corrected by the private incentive to exploit foreign dumping and that, for example, optimal production subsidies are required. Thus we find that the private sector 'under-dumps' and it would seem that our results strengthen, rather than weaken DM's results. However this is not true. It should be noted that this type of optimal dumping is a 'constrained optimum', constrained by the fact that the practice of dumping (or even trade) cannot be proscribed.

We shall show that a better solution may be for the government to remove the constraint and introduce, alongside optimal subsidies, anti-dumping policies that prohibit exports at a price (significantly) below marginal cost. This is a type of 'voluntary dumping restraint' policy (which may have the further benefit of pre-empting retaliatory tariffs by the aggrieved recipient of the dumped goods). Goods that would have been dumped are now re-directed to the home market enhancing consumer surplus. The level of government subsidy

to the industry may be higher with the anti-dumping policy than otherwise because domestic consumers are more likely to benefit from it.

Under certain but reasonable conditions, we are able to prove an even stronger result: the producer will choose to refrain from dumping voluntarily if optimal subsidies are in place. Thus the existence of dumping can be considered to arise when commercial policy is sub-optimal.

To summarize then, with optimal subsidies in place, the welfare implications of dumping can dramatically change and in fact the case for dumping becomes significantly weaker.

In Section 1, we set up the basic model and compare the outcomes under autarky, dumping and anti-dumping scenarios. Optimal subsidies are introduced in Section 2. The paper ends with some concluding comments.

Section 1 The Basic Model

We shall be concerned with a firm producing a good with a constant marginal cost technology. It has monopoly power in the domestic market for the good and faces a certain and known domestic demand curve. It has no foreign market power and the price at which it can sell abroad is a random variable with a known distribution.[1] The existence of domestic market power could be because of import protection or due to xenophobic domestic consumers. The firm practises price-discrimination between domestic sales and exports.

We shall use the following notation:

c	=	marginal cost of production
p	=	foreign price, defined continuously over the range [0,b]
F(p)	=	price distribution function
f(p)	=	price density function
q	=	production and/or sales quantity
AR(q)	=	domestic average revenue curve
MR(q)	=	domestic marginal revenue curve
TR(q)	=	total domestic revenue
s	=	production subsidy
CS	=	expected consumer surplus
PS	=	expected producer surplus
W	=	total expected surplus

Superscripts a, d, n refer to autarky, dumping and anti-dumping scenarios
'*' describes optimal subsidy outcomes

The firm is risk neutral and chooses a level of production that maximises expected profits. Once production has been decided *ex-ante*, it cannot be altered *ex-post*. When the actual foreign price is realized, the firm faces a second decision of how to allocate sales

between domestic and foreign buyers. The standard theory of price discrimination implies that the firm will equalize the marginal revenue from the two sources so that

$$p = MR(q^p) \qquad (1)$$

where q^p is the level of domestic sales when the realized foreign price is p. Price discrimination allows the firm to obtain $(AR(q^p)-MR(q^p))q^p$ of extra profits from domestic sales. Exports make up the remainder of committed production and are equal to $(q-q^p)$. Export dumping may take place in the sense that p differs from $AR(q^p)$ and may turn out to be less than marginal production costs, c .

Before developing the model any further, we shall make some additional assumptions about the price distribution and the demand function.

Assumption (i) $E(p) < c < b$

Assumption (ii) $AR(q) = \alpha - \beta q \quad ; \alpha > b$

Assumption (iii) F follows a uniform distribution over the range [0,b]

The first inequality in Assumption (i) was introduced by Davies and McGuinness(1982) to sharpen the definition of dumping and is necessary to establish an interior finite solution. They also needed the second inequality in Assumption (i) to prove the existence of dumping simply because a firm would never bother with a foreign market that always achieved a loss-making price.

It may be recalled that DM obtained the result that consumer surplus under dumping is unambiguously larger than that under autarky only under the specific assumption of linearity of demand. The first part of Assumption (ii) is therefore introduced to maintain continuity for comparison purposes, although many of our results do not rely on this assumption. The second part is introduced in this paper because it permits us to establish sub-optimal dumping results (in actual fact, the assumption is much stronger than is necessary). It means that there is no possibility of realizing an export price at which there would be no domestic demand so that the 'upside risk' on export revenues is suitably limited. For the kinds of products that are typically dumped, this does not seem to be an unreasonable assumption. Of course, if there were no such restriction, the extra production of goods for exports that might have to be dumped might always be justified because of the sufficiently high upside risk. The uniform distribution is used to ease the analysis, and without any loss of generality we take the lower end of the distribution to be zero. Our use of the uniform distribution and the restriction on b provide an analytical simplification that limits the upside risk.

The expected profits or producer surplus for a firm that can dump is given by:

$$PS^d = F(MR(q))\ AR(q)q + \int_{MR(q)}^{b} [AR(q^p)q^p + p(q-q^p)]\ dF(p) - cq \qquad (2)$$

The first term on the RHS of (2) comes from the fact that all of the committed product will be sold to domestic residents at all foreign price realizations below the domestic marginal revenue attained at that level of production. For prices above that, the allocation process takes place with q^p and $(q-q^p)$ being sold at home and abroad respectively.[2] Given Assumption (ii), q^p is always greater than zero. Maximising (2) with respect to q gives the first order condition:

$$F(MR(q^d))\ MR(q^d) + \int_{MR(q^d)}^{b} p\ dF(p) = c \qquad (3)$$

which sets expected marginal revenues equal to marginal cost. The first term on the LHS of (3) gives marginal revenue from selling the whole output at home when the foreign price is less than $MR(q^d)$. The second term gives the marginal revenue (which is identical for home and foreign sales - see (1)) which is expected in the price range $(MR(q^d),b)$ where an interior allocation outcome occurs. If we compare this condition to the standard autarkic monopoly one ($MR(q^a) = c$), it is immediately apparent after using Assumption (i) that marginal expected revenue at q^a exceeds marginal cost (see DM's proposition A). Hence $q^d>q^a$ and $c>MR(q^d)$ and it follows that export dumping occurs with positive probability (see their proposition B). Indeed, whenever circumstances lead to an increase of production, the probability of *ex-post* dumping (being $\int_{MR(q^d)}^{c} dF(p)$) will be greater. In Figure 1, the dumping and autarkic equilibria are depicted.

FIGURE 1 ABOUT HERE

The intuition for these results is based on the assumption that production decisions are made prior to sales allocation and that, under the assumptions, the upside risk on revenue has to outweigh the downside risk. This is simply because in the event of a bad foreign price realization the firm is not compelled to export a particular amount. Instead it can divert output to the home market, descending the certain domestic average revenue curve and thus shrinking downside 'losses' below upside 'gains'. Therefore, starting from the autarkic equilibrium, the firm cannot lose by producing an extra unit at the margin; the diversion to the home market would yield zero marginal profit at such an equilibrium, while substantial

profit might be reaped by exporting that unit in the event of good price realization. Now consider what the producer would do if the expected foreign price exceeded marginal cost, i.e. if $E(p) > c$. Given constant marginal cost and perfect competition abroad, the level of production would be indeterminate. However if $E(p) = c$, the firm would choose to produce to the point where $MR(q) = 0$ (where the zero comes from the bottom end of the range of p). In this event, the 'upside' of expected marginal revenue exactly balances the 'downside'; and dumping will occur in the probability sense. With $E(p)<c$, the firm is obliged to move production up the marginal revenue curve from the point $MR(q)=0$, so as to shrink the downside probability to compensate for 'average export losses'. Clearly the dumping option enhances expected producer surplus relative to autarky even though $E(p)<c$. In fact, one can interpret the firm's choices under dumping to be analagous to a financial option where the downside and upside risk are asymmetrically restricted.

However it is not immediately apparent that domestic consumers would welcome dumping. Consumer surplus under autarky and dumping are given by:

$$CS^a = \int_0^{q^a} AR(q)\ dq - AR(q^a)\ q^a \qquad (4)$$

$$CS^d = F(MR(q^d)\ [\int_0^{q^d} AR(q)\ dq - AR(q^d)\ q^d] + \int_{MR(q^d)}^{b} [\int_0^{q^p} AR(q)dq - AR(q^p)q^p]\ dF(p) \qquad (5)$$

Subtracting (4) from (5) and noting that $1-F(MR(q^d))= \int_{MR(q^d)}^{b} dF(p)$, we get:

$$CS^d - CS^a = \int_{q^a}^{q^d} AR(q)\ dq - (TR(q^d)-TR(q^a)) + \int_{MR(q^d)}^{b} [\int_{q^d}^{q^p} AR(q)\ dq - (TR(q^p)-TR(q^d))]\ dF(p) > 0 \qquad (6)$$

where $TR(q) = AR(q)q$ is the total revenue earned from domestic sales. The terms on the RHS of (6) are simply familiar welfare triangle differences.

Since $q^d>q^a$ and $q^d>q^p$ (as $MR(q^p=p>MR(q^d)$), the first term on the RHS of (6) is positive while the second is negative. The first represents the increase in consumer surplus because of increased monopoly output when dumping is permitted. When the export price realization is bad in the sense that $p<MR(q^d)$, all the output is diverted to the home market and in that event the home consumers enjoy a big surplus. However when $p>MR(q^d)$, part of the output is exported, something that does not occur under autarky. Therefore in the export price range $[MR(q^d),b]$ there is a loss of expected consumer surplus for dumping relative to

autarky. This is precisely what is shown by the second term on the RHS of (6). As mentioned above, DM have shown that the gain from the first term will always exceed the loss from the second under our assumptions.

We now wish to consider whether an anti-dumping policy, which forbids exports at prices below domestic marginal cost, would make consumers and producers better off. Under this policy, producer surplus is:

$$PS^n = F(c)\, AR(q)q + \int_c^b [\, AR(q^p)\, q^p + p(q-q^p)]\, dF(p) \; - c\, q$$

and so the first order condition for producers becomes:

$$F(c)\, MR(q^n) + \int_c^b p\, dF(p) \quad = \quad c \qquad (7)$$

and by the same argument given below (3), we can deduce that $q^n>q^a$ and $c>MR(q^n)$. Comparing (3) and (7), we see that

$$F(c)\, [\, MR(q^n) - MR(q^d)\,] = \int_{MR(q^d)}^{c} (p-MR(q^d))\, dF(p) \quad > 0$$

and so $q^d>q^n$. It is apparent that producers are worse off because the policy adds an additional constraint to their maximization problem.

Hence we can be sure that:

$$q^d \quad > \quad q^n \quad > \quad q^a$$

The difference in consumer surplus is:

$$CS^d-CS^n \quad = F(c)\, [\, \int_{q^n}^{q^d} AR(q)\, dq - (TR(q^d)-TR(q^n))\,] + \int_{MR(q^d)}^{c} [\int_{q^d}^{q^p} AR(q)dq - (TR(q^p)-TR(q^d))]\, dF(p) \qquad (8)$$

and once again, there is a positive term and a negative term with a similar explanation to that given for (6). Under our specific assumptions, it can be shown that CS^d is always larger than CS^n. To see this, observe that (3) and (7) can be written as

$$q^d - q^n \quad = [c-MR(q^d)]^2/(4c\beta)$$

or

$$(q^d)^2-(q^n)^2 \quad = (q^d+q^n)\, [c-MR(q^d)]^2/(4c\beta) \qquad (9)$$

Now (8) simplifies to:

$$(2b/\beta)\, (CS^d-CS^n) \quad = MR(q^d)\, (q^d)^2 \; - c\, (q^n)^2 + \int_{MR(q^d)}^{c} (qp)^2 dp \qquad (10)$$

and by using the Trapezoidal approximation for definite integrals, the last term can be written as $((q^a)^2+(q^d)^2)(c-MR(q^d))/2$. Now, using the fact that $c-MR(q^d) = 2\beta(q^d-q^a)$, the RHS of (10) becomes

$$(c-MR(q^d))(q^d-q^a)\, (q^a-q^a)\, /\, 2 \; > 0$$

QED.

We can now state our first proposition which is much stronger than those presented by DM.

Proposition 1 Dumping is better than autarky or anti-dumping for both producers and consumers.

Now that we have managed to strengthen the dumping proposition, we shall try to search for an answer to our question 'do private markets deliver the socially optimal degree of dumping?'. This is taken up in the next section where we recognise that there is a fundamental monopoly distortion in the system which we shall allow the government to correct by applying a production subsidy policy. We do not consider an export or consumption subsidy because they have the additional effect of distorting the allocation process and thereby introducing unrewarding complications.

Section 2 Introducing Optimal Subsidies

2.1 Autarky

Before launching into the dumping and anti-dumping scenarios, we shall briefly present the features in autarky with an optimal production subsidy. Profit maximisation leads to:

$$MR(q^a) \quad = \quad c \quad - s^a$$

Total surplus (being producer surplus plus consumer surplus less lump-sum taxes[3] to finance the subsidy) is simply:

$$W^a \quad = \quad \int_0^{q^a} AR(q)\, dq \; - cq^a$$

and the government chooses a subsidy that maximizes this. The optimal solution implies marginal cost pricing because:

$$AR(\hat{q}^a) = c \qquad (11)$$

and

$$s^a = AR(\hat{q}^a) - MR(\hat{q}^a) > 0 \qquad (12)$$

2.2 *Dumping*

Let us now apply an optimal subsidy to the dumping model. The first order condition for the producer becomes:

$$F(MR(q^d))\, MR(q^d) + \int_{MR(q^d)}^{b} p\, dF(p) = c - s^d \qquad (13)$$

The formula for consumer surplus is unchanged from (5) although the value of q^d will be different. When the government maximises total surplus, the optimal subsidy is:

$$s^d = F(MR(\hat{q}^d)\,[\,AR(\hat{q}^d) - MR(\hat{q}^d)\,] > 0 \qquad (14)$$

There is an obvious similarity between (14) and (12). The optimal subsidy is determined at the margin associated with $\hat{q}^d$. It bridges the gap between average and marginal revenue at the optimal production point, which in the case of dumping is deflated by the probability of all production going to domestic sales. The fact that s^d is strictly positive[4] indicates that $\hat{q}^d$ exceeds q^d and so permits us to state:

Proposition 2 *Assuming that the practice of dumping occurs and cannot be prevented, the privately-optimal level of dumping is less than the socially-optimal one.*

This under-dumping result means that while dumping does encourage a monopolist to produce more, this extra production does not adequately correct for the distortion associated with home monopoly power. The inadequacy comes about because the profit motive does not coincide with the welfare one. Consumer surplus must improve with a marginal subsidy at the zero-subsidy point, q^d, in proportion to $[\,AR(q^d)-MR(q^d)]$. This must be balanced by the fact that a tax has to be raised as the subsidy departs from zero. This leads to an optimal subsidy that is positive, and it implies an even stronger dumping result than in Proposition 1.

From our propositions 1 and 2, it would seem that the government should not only refrain from placing restrictions on trade or dumping, it should positively encourage dumping. This however is not true. We shall now show that once optimal subsidies are in place, welfare comparisons look very different.

2.3 *Comparing Dumping with Autarky*

The next important question to answer is whether the optimal subsidised output under dumping is greater or less than that under autarky. From (3) above, we know that the privately optimal dumping output exceeds the autarkic one. We shall now demonstrate the opposite result for the socially optimal levels.

Applying the optimal subsidy in (14) to (13), the first order condition is:

$$\int_{MR(\hat{q}^d)}^{b} [p - AR(\hat{q}^d)]\, dF(p) = c - AR(\hat{q}^d) \qquad (15)$$

which must be compared with (11). If the LHS of (15) is negative, then it follows that $AR(\hat{q}^d)>AR(\hat{q}^a)$ and that $\hat{q}^d<\hat{q}^a$.

Using our assumptions the LHS of (15) is:

$$\int_{MR(\hat{q}^d)}^{b} [p - AR(\hat{q}^d)]\, dF(p) = [b-\alpha]\,[b-MR(\hat{q}^d)] / [2b] < 0 \qquad (16)$$

Under our particular assumptions and the obvious condition that dumping is feasible ($b>MR(\hat{q}^d)$), this is negative. One can immediately see the role of Assumption (ii) which determines the sign of the only ambiguous term on the RHS of (16). Evidently what we have needed to ensure that the integral in (16) is negative is that the prospect of achieving substantial excess revenue from exports should be suitably limited. Thus given our assumptions we know that:

$$\hat{q}^d < \hat{q}^a \qquad (17)$$

From (17) and (15), we can deduce that $c<AR(\hat{q}^d)$, so that if all output had to be sold at home (because of a low realization of p) there would be super-marginal cost pricing. This will be of some importance in understanding why consumer surplus differs between autarky and dumping scenarios.

We now consider how producers would regard the choice between autarky and dumping when optimal subsidies are in place. A way of looking at the comparison can be had from the following decomposition of the differential producer surplus. The optimally

subsidised producer surplus under dumping can be obtained by adding the optimal subsidy (derived in (14)) to (2) and then applying the first order condition, (13). In autarky, producers obtain $\hat{s}^a\hat{q}^a$ because ex-subsidy profits must be zero. The differential is:

$$\hat{PS}^d - \hat{PS}^a = [\hat{s}^d\hat{q}^d - \hat{s}^a\hat{q}^a] + \int_{MR(\hat{q}^d)}^{b} q^p(AR(q^p)-p)\, dF(p) \qquad (18)$$

The second term on the RHS of (18) represents the excess profits obtained from the fact that the firm can price-discriminate. Under our assumptions, we shall now demonstrate that this positive second term has to be dominated by the negative first term (since $\hat{q}^a>\hat{q}^d$, it follows from (14) and (12) that $\hat{s}^a>\hat{s}^d$) which describes the differential subsidy reaped.

Using (12), (14), (1), Assumption (i)- (iii) and the Trapezoidal approximation in (18), we get

$$\begin{aligned}\hat{PS}^d - \hat{PS}^a &= \beta[(\hat{q}^d)^2 F(MR(\hat{q}^d)) - (\hat{q}^a)^2] + \int_{MR(\hat{q}^d)}^{b} (\alpha-p)^2/4\beta \; dF(p) \\ &= \beta(\hat{q}^d - \hat{q}^a)(\hat{q}^d + \hat{q}^a) + \int_{MR(\hat{q}^d)}^{b}[(\alpha-p)^2/4\beta - \beta(\hat{q}^d)^2]\, dF(p) \\ &= \beta(\hat{q}^d - \hat{q}^a)(\hat{q}^d + \hat{q}^a) - (\alpha-b+2\beta\hat{q}^d)(b-\alpha+2\beta\hat{q}^d)^2/4\beta \qquad (18a) \\ &< 0 \quad \text{because of Assumption (ii) and (17)} \qquad \text{QED}\end{aligned}$$

Under our assumptions, we shall also be able to prove that consumer surplus will be larger under autarky than under dumping. Given marginal cost pricing, socially optimal consumer surplus (excluding the necessary lump-sum tax that finances the producer subsidy) under autarky would be:

$$\hat{CS}^a = \int_0^{\hat{q}^a} AR(q)\, dq - c\hat{q} = \tfrac{1}{2}(\hat{q}^a/2)(\alpha - c) \qquad (19)$$

Under dumping, the related measure would be (from (5) at $\hat{q}^d$):

$$\begin{aligned}\hat{CS}^d &= F(MR(\hat{q}^d)(\delta'/2)[\alpha - AR(\hat{q}^d)] + \int_{MR(\hat{q}^d)}^{b}(q^p/2)[\alpha - AR(q^p)]\, dF(p) \\ &= (\hat{q}^d/2)(F(MR(\hat{q}^d)\alpha - c) + \\ &\quad \int_{MR(\hat{q}^d)}^{b} \tfrac{1}{2}[q^p\alpha + p(\hat{q}^d - q^p) - q^p(AR(q^p)-p)]\, dF(p) \qquad (20)\end{aligned}$$

Subtracting (19) from (20) after applying (15) gives:

$$\begin{aligned}\hat{CS}^d - \hat{CS}^a &= \tfrac{1}{2}(\hat{q}^d - \hat{q}^a)(\alpha - c) + \tfrac{1}{2}\int_{MR(\hat{q}^d)}^{b}[(p-\alpha)(\hat{q}^d - q^p) - q^p(AR(q^p)-p)]\, dF(p) \\ &< 0 \qquad (21)\end{aligned}$$

The RHS of (21) has to be negative because $\hat{q}^d<\hat{q}^a$, $\alpha>c$, $b<\alpha$, $\hat{q}^d>q^p$ and $AR(q^p)>p$. Consumer surplus is larger under autarky than under dumping primarily because under the former purchases are at marginal cost, whereas under the latter, even for the best realizations for the consumer (where $p<MR(\hat{q}^d)$), domestic purchases are priced above marginal cost (see (15)).

We must finally check on the total surplus differential which comes from adding (18) and (21) and subtracting the tax differential implied by the subsidy. This last subtraction cancels with the first term on the RHS of (18) and so we get:

$$\begin{aligned}\hat{W}^d - \hat{W}^a &= \tfrac{1}{2}(\hat{q}^d - \hat{q}^a)(\alpha - c) + \tfrac{1}{2}\int_{MR(\hat{q}^d)}^{b}[(p-\alpha)(\hat{q}^d - q^p) - q^p(AR(q^p)-p)]\, dF(p) \\ &\quad + \int_{MR(\hat{q}^d)}^{b} q^p(AR(q^p)-p)\, dF(p) \\ &= \tfrac{1}{2}(\hat{q}^d - \hat{q}^a)(\alpha - c) + \tfrac{1}{2}\int_{MR(\hat{q}^d)}^{b}[(p-\alpha)(\hat{q}^d - q^p) + q^p(AR(q^p)-p)]\, dF(p) \\ &\gtrless 0 \qquad (22)\end{aligned}$$

Unfortunately we cannot sign this *a priori*. In moving to autarky, there is a fundamental tradeoff between the improvement to consumer surplus and the loss of profits from denying producers the benefits of price discrimination. If profits from price discrimination were considered fundamentally to be a 'bad', or if a low weight were attached to it,[5] then clearly the shift to autarky would be desirable. It would not be too difficult to persuade society to downgrade the weight attached to profits obtained by charging home consumers higher prices than foreigners!

We now state:

Proposition 3 *The socially optimal level of output, producer surplus and (pre-tax) consumer surplus is lower under dumping than under autarky.*

2.4 Comparing Anti-Dumping to Autarky and Dumping

We must now introduce the anti-dumping policy and see how it fares relative to the other two alternatives. Given the result in (8), one may expect that this 'intermediate' policy will give an 'intermediate' result. Let us see.

Under anti-dumping, the cut off point for exports is where $p=c$ and so the optimal

subsidy (analagous to (14)) and first order condition for producers (analagous to (15)) are:

$$\hat{s}^n = F(c)\,[\,AR(\hat{q}^n) - MR(\hat{q}^n)\,] > 0 \tag{23}$$

and

$$\int_c^b [p - AR(\hat{q}^n)]\,dF(p) = c - AR(\hat{q}^n) \tag{24}$$

To determine which is larger, $\hat{q}^n$ or $\hat{q}^d$, we subtract (24) from (15) which gives:

$$\int_{MR(\hat{q}^d)}^c [p - AR(\hat{q}^d)]\,dF(p) = F(c)\,[\,AR(\hat{q}^n) - AR(\hat{q}^d)\,] \tag{25}$$

The LHS of (25) is very easy to sign because we know from Assumption (i) that b>c and that the LHS of (16) is negative using Assumptions (ii) and (iii). We can conclude therefore that $AR(\hat{q}^n) - AR(\hat{q}^d) < 0$ so that $\hat{q}^n > \hat{q}^d$.

We shall now find out if it is in the interest of the producer to put a no dumping restriction on itself. For this, we need to compare producer surplus under dumping with that under no dumping. Using (1), (14), (23) and the analogous equation to (18) we obtain:

$$\hat{\Pi}^n - \hat{\Pi}^d = \beta[(\hat{q}^n)^2 - (\hat{q}^d)^2]\,F(c) - \int_{MR(\hat{q}^d)}^c \beta\,[(q^p)^2 - (q^d)^2]\,dF(p)$$

$$= \beta[(\hat{q}^n)^2 - (\hat{q}^d)^2]\,F(c) + [c - MR(\hat{q}^d)]^2[\alpha - c + 2\beta\hat{q}^d]/(8\beta) > 0 \tag{26}$$

because $\hat{q}^n > \hat{q}^d$ and $\alpha > c$. So we see that the producer will not wish to dump.

In the same way the comparison between $\hat{q}^n$ and $\hat{q}^a$ is obtainable from:

$$\int_c^b [p - AR(\hat{q}^n)]\,dF(p) = [\,AR(\hat{q}^a) - AR(\hat{q}^n)\,] \tag{27}$$

With our assumptions, (27) becomes

$$[\,(b - AR(\hat{q}^n) + \beta(\hat{q}^n - \hat{q}^a)\,]\,(b-c)/2b = \beta(\hat{q}^n - \hat{q}^a)$$

or

$$(\hat{q}^n - \hat{q}^a) = (b-c)\,(b - AR(\hat{q}^n))\,/\,(b+c)$$

Thus we can see that output under autarky will be higher (lower) if $b <(>) AR(\hat{q}^n)$. This means that if the upper bound of the foreign price distribution is quite low, then autarkic output would be higher than dumping output. Thus we can only be sure that:

$$\begin{aligned} \hat{q}^a &> \hat{q}^d \\ \hat{q}^n &> \hat{q}^d \end{aligned} \tag{28}$$

Somewhat surprisingly, output under anti-dumping is not necessarily intermediate between dumping and autarky, and it is interesting to note that there is a very different output ordering for the privately and socially optimal solutions (compare (28) with (7)).

We have already shown in (26) and (18a) that dumping yields the lowest producer surplus. However, unfortunately, we cannot determine which yields the highest. Nevertheless we are able to conclude that, because the producer is free to refrain from dumping, it will do so provided the government applies the appropriate optimal subsidy.

Let us now turn to consumer surplus. Under anti-dumping this can be expressed as:

$$\hat{CS}^n = (\hat{q}^n/2)(\,F(c)\alpha - c\,) + \int_c^b \tfrac{1}{2}[q^p\alpha + p(\hat{q}^n - q^p) - q^p(AR(q^p) - p)]\,dF(p) \tag{29}$$

The differential in consumer surplus between anti-dumping and autarky is now unclear, in contrast to (21). It can be written as

$$\hat{CS}^n - \hat{CS}^a = \tfrac{1}{2}(\hat{q}^n - \hat{q}^a)(\alpha - c) + \tfrac{1}{2}\int_c^b [(p-\alpha)(\hat{q}^n - q^p) - q^p(AR(q^p) - p)]\,dF(p) \gtrless 0 \tag{30}$$

The ambiguity arises from the first term on the RHS of (30) because we cannot sign $\hat{q}^n - \hat{q}^a$. Anti-dumping may be better for consumers than autarky if the former implies higher output and thus more to consume when exports are unviable. On the other hand, in the region <c,b> some of the extra output would go abroad and consumers cannot be pleased about this directly.

The comparison for consumer surplus between dumping and anti-dumping is however clear. The differential is:

$$\hat{CS}^d - \hat{CS}^n = \tfrac{1}{2}(\hat{q}^d - \hat{q}^n)\,\{\,F(c)\alpha - c + \int_c^b p\,dF(p)\,\} + \tfrac{1}{2}\int_{MR(\hat{q}^d)}^c [(p-\alpha)(\hat{q}^d - q^p) - q^p(AR(q^p) - p)]\,dF(p) < 0 \tag{31}$$

The second term on the RHS of (31) is negative using the same argument as given below (21). Thus the RHS will definitely be negative if the expression in braces in the first term is positive. That expression can be manipulated to give:

$$F(c)\alpha - c + \int_c^b p\, dF(p) = \int_c^b (p-\alpha)\, dF(p) - c + \alpha \qquad (32)$$

However we know from the first order condition (24) that

$$\int_c^b (p-AR(\hat{q}^n))\, dF(p) - c + AR(\hat{q}^n) = 0 \qquad (33)$$

and since $\hat{q}^n > 0$, the expressions in (32) must be positive. Hence we can state categorically that consumer surplus is larger under anti-dumping than under dumping.

To summarise, we have been able to show that

$$\hat{CS}^a > \hat{CS}^d \;;\; \hat{CS}^n > \hat{CS}^d \;;\; \hat{CS}^a \gtrless \hat{CS}^n$$
$$\hat{PS}^a > \hat{PS}^d \;;\; \hat{PS}^n > \hat{PS}^d \;;\; \hat{PS}^a \gtrless \hat{PS}^n$$

Finally, we need to compare total surplus differentials under the three scenarios. For anti-dumping versus dumping, we obtain:

$$\hat{W}^d - \hat{W}^n = [\hat{CS}^d - \hat{CS}^n] + \int_{MR(\hat{q}^d)}^{c} [q^p(AR(q^p)-p)]\, dF(p) \gtrless 0 \qquad (34)$$

The ambiguity arises here for the same reason as in (22). Consumers prefer an anti-dumping policy, but to the extent that it is applied (here in the range $<c, MR(\hat{q}^d)>$), profits from price-discrimination have to be foregone. Once again, if there is little or no sympathy for these lost profits, an anti-dumping policy will be popular.

Finally how far should these export restrictions go? As far as autarky? We cannot say because the welfare comparison between anti-dumping and autarky is decidedly ambiguous. This is because we can no longer be sure that consumer surplus will improve as we move towards autarky - see (30).

We now present our final proposition that summarizes the results in this sub-section:

Proposition 4 *When socially optimal subsidies are given to a monopolist that can dump goods abroad, the producer will not dump. Output and (pre-tax) domestic consumer surplus will be higher than if dumping had taken place. It is even possible that these voluntary export restrictions should be prohibitive leading to autarky.*

Section 3 Concluding Comments

The commonplace practice of dumping has tended to aggravate the governments of countries receiving those goods because their own producers rightly complain about unfair competition. Naturally their consumers are happy with the prospect of receiving cheap goods. On the other hand, the dumping country's producers must be gainers while one would imagine that their consumers would be losers. This last statement has been shown in the literature to be false.

We have focused on welfare considerations in the dumping country. Having realized that monopoly power conveys a standard distortion, we apply optimal subsidies to deal with that and then analyze whether dumping is in fact optimal for the domestic economy. We are able to find reasonable conditions under which dumping will not take place provided the government applies optimal subsidies.

The fundamental trade-off on the dumping/subsidy question turns out to be between the clear loss in domestic consumer surplus from being charged prices above marginal cost and the clear gain by producers from being able to price discriminate. EC agricultural dumping on the Soviet Union has certainly become less prevalent because domestic EC consumers have managed to harness effective opposition to the producer lobby. From our analysis, it is clear that it would be inappropriate for the EC to ban dumping abroad - rather it should pre-empt dumping by ensuring that agricultural subsidies are optimal. Both an excessive and an inadequate pattern of subsidies will encourage dumping. Of course, the model that we have used is a simplistic caricature of the Common Agricultural Policy in the EC; in fact it operates as a complex price support scheme with inventories. One could easily extend our analysis to a multi-period context with convex inventory costs and supply uncertainty. Nevertheless we conjecture that the results of our simplified model will not be altered in this wider context. However if we relaxed the internal monopoly assumption, the structure of the model would be significantly altered; it remains open for future research to see whether our propositions are robust to this change.

Another limitation of our analysis is that we abstract entirely from the predatory aspect of dumping. This adds another dimension because the foreign market cannot be modelled as perfectly competitive. However even in this type of model, net welfare comparisons will not be straightforward.

Footnotes

1. Bernhardt(1984) develops a model where the domestic demand curve is subject to uncertainty, while the foreign price is deterministic. The results in our paper would go through if the both the foreign and domestic demand curves were stochastic. However the possible existence of dumping at below marginal cost requires that the foreign price be stochastic. The source of this randomness could be, among others, exchange rate fluctuations.

2. If the firm was forced to abandon its practice of price discrimination, the expected foreign price would be equal to the 'expected' domestic price which by Assumption (ii) would both be below marginal cost. Thus the firm would produce no output.

3. Throughout the paper, we assume that the production subsidy is fully financed by non-distortionary taxes. This is not an innocuous assumption and does not reflect the real policy choices facing governments. However it is a standard theoretical assumption which serves to simplify the analysis.

4. If $E(p)=c$, then $MR(\hat{q}^d)=0$ and so $\hat{s}^d=0$. Thus in this special case, the private dumping outcome coincides with the socially optimal one.

5. Clearly, the optimal subsidy would depend on the weights in the welfare function.

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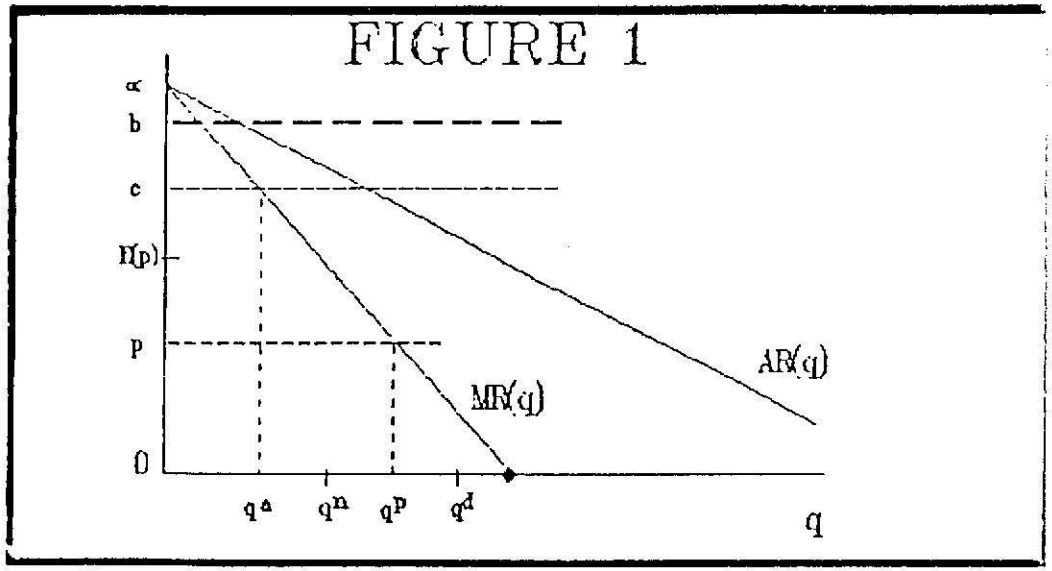
FIGURE 1



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