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Anti-dumping laws have been on the books for many decades in the US and Europe. In the last fifteen years they have they been intensively utilized. Finger and Murray (1990) conclude that anti-dumping is where the action is. Significantly, about half of the US anti-dumping cases (348 of 774) from 1980 to 1988 ended with Voluntary Export Restraints (VERs) rather than Anti-Dumping Duties (ADDs). At the same time, separately from anti-dumping enforcement, political pressure has resulted in the proliferation of 'political' VERs in textiles and apparel, footwear and autos. Anderson (1992) shows that the coincident explosions in anti-dumping enforcement and VERs may be explained by domino dumping: exporting firms dump in the present to secure the option of receiving more export licenses in the future when there is a positive probability of a future VER. The exporters' dumping thus both raises the political pressure for protection and triggers anti-dumping enforcement, the latter ending in the remedies of ADDs or VERs.

This paper takes up anti-dumping policy from the point of view of the importing country. Anti-dumping policy works in a three stage process, with its effects analyzed by backward induction. The probability of being caught dumping is determined in an initial 'rules' stage in which enforcement effort is determined. The analytic seperation of the rules stage from the remaining stages corresponds approximately to the actual process, in which enforcement effort is changed infrequently.[1] As a preliminary to modeling the rules stage, this paper analyzes in Sections I and II the remaining two stages of the process, which take

[1]Trade law, which is revised infrequently, frames the basic rules. Enforcement effort is shifted periodically under executive discretion. In the US case, the President appoints the commissioners of the International Trade Commission (ITC), which is responsible for investigation of injury due to dumped imports. The ITC rejected a substantial number of cases in the last decade. The Commerce Department, also under Presidential appointment, is responsible for investigation of dumping in the first place, and nearly always finds dumping.

the enforcement probability as given. Then Sections III and IV analyze the enforcement interests of two parties, the 'public', and the rent-seekers respectively.[2]

The first task of the paper is to set out a two stage model in which, given the probability of anti-dumping enforcement, the current trade volume is determined simultaneously with the probabilities of a future VER, or of an ADD. The current trade volume is set by expected profit maximizing competitive export firms which take all probabilities as given (Anderson (1992)). The probabilities of a future VER or ADD are determined by the anticipated future rent-maximizing activities of specific factor owners in the domestic import-competing industry. (In Anderson (1992) the probability of a VER was endogenous, but not modeled.) A simultaneous determination is necessary since the level of current trade affects the rent gain which comes from a VER or an ADD. The model is set out in Section I.

The current trade volume, and the probabilities of a future VER and of free trade have interesting comparative static properties with respect to increased enforcement effort, modeled as the probability of being caught dumping. Section II contains the results. First, increased enforcement may perversely lead to a rise in dumping due to the possibility of obtaining a VER as an anti-dumping remedy. Second, while a standard defense of 'fair trade' legislation such as anti-dumping laws is that it helps preserve a liberal trade order, increased enforcement may increase the probability of a VER and may reduce the probability of free trade.

Sections III and IV consider the interests of two parties at the rules stage. The 'public' interest is to set enforcement levels to raise expected social surplus. (The President, facing a national election in which general prosperity matters, acts in the 'public interest'. Whether this traditional story is approximately accurate or not, analyzing the 'public interest' is at least relevant to the 'rules' stage of the anti-dumping process.) The rent-seekers' interest is to set enforcement levels to raise expected rent. Intuitively, it

[2]No full model of the determination of the anti-dumping enforcement effort is offered, since in contrast to this paper, a general political equilibrium model is required in which many interests compete.

appears obvious that rent-seekers will prefer enforcement and that the executive will prefer no enforcement. Paradoxically, it is possible for rent-seekers to prefer no enforcement, and for the executive to prefer enforcement.[3] These results arise due to the second-best nature of the problem. Section III also shows that it is always in the public interest to permit some dumping.

Section V concludes with a sketch of future work. First, the simple model here rationalizes a number of characteristics of the recent explosion of anti-dumping activity, and may be empirically testable. Second, the elements isolated here should be important in a wide variety of extended models which include significant complicating factors, such as imperfectly competitive firms, activist governments on both sides of the market, and a deeper look at the political economy of the rules stage. Third, the model should serve as the starting point for the analysis of anti-dumping codes, such as are currently discussed in GATT negotiations.

I. The Model

The economic structure is very simple. A homogeneous good is produced by foreign and domestic firms. Perfect competition prevails in the domestic market. The world market is segmented by costs due to advertising, packaging, labeling, and safety regulations; so that conditions elsewhere do not set the price in the domestic market. (The degree of competitiveness is not essential. Also, the partial equilibrium simplification is not important. In contrast, market segmentation is necessary.) The domestic inverse demand curve is downward sloping. The marginal cost curves for domestic and foreign firms are

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[3] The literature has offered some rationale for anti-dumping policy based on different models of intertemporal linkage. Ethier (1982) shows that sticky wages and quasi-fixity of employment via contract can give rise to the desirability of a dumping policy by the exporter, and an anti-dumping policy by the importer. In practice, however, the large number of adjustment cost studies done in the last fifteen years for the U.S. always show these costs to be a fraction, usually a small fraction, of the consumer cost of protection. To an unbiased observer, the adjustment cost argument for the U.S. is implausible. It becomes more plausible as employment contracts shift labor costs into fixed costs, as Ethier argues.

Ethier (1988) reviews the rationale in oligopolistic markets and finds it unconvincing. But where intertemporal linkage prevails, as in the present model, ADDs have an important strategic role, shifting the behavior of foreign rival firms. See Gruensprecht (1988).

(weakly) upward sloping. Foreign and domestic firms can differ but each nations' firms are identical.

In the future, there are two markets operating in sequence. The economic market in period 2 delivers the trade volume under either free trade, a VER or an ADD. The political market at the beginning of period 2, prior to trade, delivers the trade policy. In the economic market in period 1, the present free trade level of exports is set by 2 period expected-profit-maximizing firms. The level of current exports affects the equilibrium probabilities in the future political market, and under rational expectations, this affects the current level of exports by probability-taking firms. The simultaneous equilibrium of both markets is analyzed in subsection I.3, following analysis of the political market in subsection I.1 and the current economic market in subsection I.2.

I.1 Political Economy

Baldwin (1985) notes that the US trade policy process can be separated into two parts, administrative and political.[4] The political process is driven by the standard special interest logrolling model. The administrative process is driven by rules. In this section and the next, the rules are exogenous. In sections III and IV, attention turns to the benefit to 'public interest' and to the rent-seekers, respectively, of changing the rule in a 'rule' stage of the game, which occurs earlier than the 'present'.

The form of pressure group protection is assumed to be a VER, which is empirically accurate for developed countries in the last 20 years, apparently due to the executive's desire to avoid the foreign retaliation which follows a tariff, under GATT rules. The level of the VER, $\bar{Q}$ is assumed here to be set by a bargaining process between the home and foreign governments which is exogenous to current decisions of the exporters. This is a harmless simplifying assumption so long as exporters are competitive --- taking

[4]Most developed nations have administrative protection as well as political protection, but the details differ.

the export price, and the probability and level of the VER as given. (In contrast, Anderson (1992) characterizes the export governments' strategic behavior).[5]

Rent-seekers are assumed to own a sector-specific factor of production, e.g., specific human capital. Free entry drives all pure economic profit to zero.[6] Nevertheless, the sector-specific factor of production earns economic rent. Political market actions produce additional rent, but at a cost. For simplicity, the cost of obtaining anti-dumping enforcement is set equal to zero. (In fact, the cost of filing an anti-dumping suit is very low compared to the cost of lobbying for a VER.)

There is a fixed probability, β, of an anti-dumping enforcement action at the beginning of period 2. Following the free trade economic market equilibrium of period 1, the political markets open at the outset of period 2. If there is enforcement, at the beginning of period 2 an ADD can be obtained with no cost to rent-seekers. Nevertheless, depending on the lobbying cost at the beginning of period 2 (random at the beginning of period 1), the rent with a VER may sufficiently exceed the rent with an ADD so as to pay for the cost of obtaining a VER, which is then a remedy to the anti-dumping case.[7] If there is no enforcement, at the beginning of period 2 the rent-seekers choose to obtain a VER if amount by which the rent with a VER exceeds the rent with free trade is greater than the lobbying cost, random at the beginning of period 1. The possibilities are summarized in the decision tree for the political market at the beginning of period 2 below, along with the associated probabilities. π is the probability of a VER conditional on no enforcement. γ is the probability of a VER conditional on enforcement.

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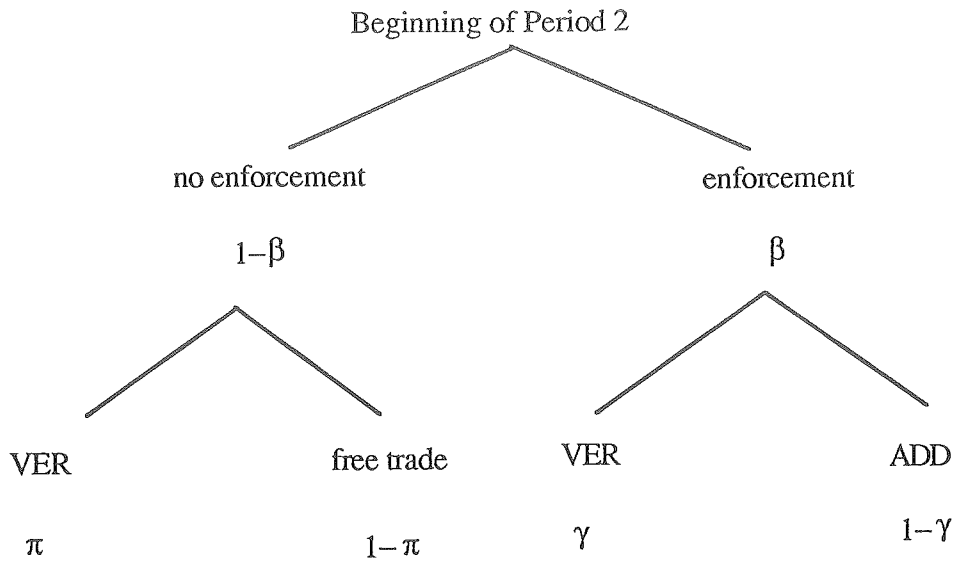
[5]Of course, the level of the VER is subject to political influence in a fourth stage of the model. It is not necessary for present purposes to explicitly model this process.

[6]This is a simplifying assumption of no consequence. Positive profit, if any, plays the same role as rent.

[7]The assumption of perfect competition excludes the interesting possibility of a private settlement of the case with a 'private VER'. See Staiger and Wolak (1992) for an analysis.



The key probabilities π and γ are determined by the actions of the rent seekers.

The rent-seekers receive the difference between the value of production, PY, and the cost of production exclusive of payments above opportunity cost to the sector-specific factor, C(Y). P is the domestic price, a function of domestc production Y plus imports Q. The competitive equilibrium level of Y, Y*(Q), is selected by domestic competitive firms such that $P(Q+Y^*) = C_Y(Y^*)$.[8] Here, and in the remainder of the paper, a subscript denotes differentiation. The total rent to the specific factor in the domestic industry is:

$$(1.1) \quad R(Q) = P(Q+Y^*(Q))Y^*(Q) - C(Y^*(Q)).$$

The marginal effect of a rise in Q upon the rent received is negative:

$$(1.2) \quad R_Q = P_Q Y^* < 0,$$

where P_Q is equal to $\frac{dP}{d(Q+Y^*)}\left(1 + Y^*_Q\right)$. Henceforth, P(Q) denotes the reduced form dependence of demand price on Q.

The rent-seekers will choose to obtain a VER in period 2 in the absence of an anti-dumping enforcement if the lobbying cost of obtaining it, K, is less than the gain, $R(\bar{Q}) - R(Q^1)$. With no intervention, the level of exports in period 2 is assumed to remain at its

[8]This is implied by the value of marginal product condition for the intersectorally mobile factors of production. The model is of partial equilibrium for simplicity, but nothing essential is changed by allowing for general equilibrium.

period 1 level. The cost of obtaining the VER in period 2 is a random variable in period 1.[9] Specifically, K is drawn from a uniform distribution with support $[0,K_{max}]$. Then the probability of a *political* VER is equal to:[10]

$$(1.3) \quad \pi(Q^1) = \frac{R(\bar{Q}) - R(Q^1)}{K_{max}}.$$

A parameter which will be important in subsequent analysis is the elasticity of the probability of a VER with respect to Q. Differentiating (1.3) and using (1.2):

$$(1.4) \quad \pi_Q Q^1/\pi = \frac{-Y^*P_Q Q^1}{R(\bar{Q}) - R(Q^1)} = \frac{1}{\varepsilon^1\rho^1} > 0,$$

where ε^1 is the elasticity of import demand, $-P/P_Q Q^1$, and ρ^1 is the rent increase relative to the current value of domestic output, $\left(R(\bar{Q}) - R(Q^1)\right)/P(Q^1)Y^*(Q^1)$.

An affirmative dumping finding presents the rent-seekers with a different opportunity. At no cost they will receive an ADD. Alternatively they can lobby the legislature and the executive for a VER at a reduced cost based on public sympathy for the 'dumpees'.[11] (In US trade law, an ADD requires that there be *injury by means of dumped imports* .) The VER will be more favorable to rent-seekers than the anti-dumping duty (ADD)[12], and they will lobby for it if the gain is greater than the cost, L. Let Q^t be the equilibrium level of imports under the anti-dumping duty. The rent-seekers will lobby for an *anti-dumping VER* if $R(\bar{Q}) - R(Q^t) \geq L$.[13] In period 1, L is unknown, and distributed

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[9]The randomness reflects a political process with many independent influences. A deeper model, which might be the subject of future work, would suggest predictable conditional elements in the cost, K, along the standard lines for dichotomous choice models.

[10]The domain of the function defined in (1.3) is restricted to Q^1 between 0 and Q*, the latter being the value of Q^1 such that the right hand side of (1.3) is less than or equal to one. For Q^1 above the critical value, π is equal to one. The only interesting cases are where Q^1 is in the domain of $\pi(Q^1)$, because for larger values of imports the VER is certain and can be assumed to already be imposed.

[11]The cost may also be lower because the exporting firms have a strong incentive to help lobby for a VER as opposed to the alternative anti-dumping duty.

[12]This follows from the domino dumping behavior of the exporting firms detailed in the next subsection.

[13]The VER level is assumed to be the same under the anti-dumping and political processes. This is an inessential simplification.

uniformly on the interval $[0,L_{max}]$. The probability of an *anti-dumping* VER, given an affirmative anti-dumping finding, is then:

$$(1.5) \quad \gamma = \frac{R(\bar{Q}) - R(Q^t)}{L_{max}}.$$

Next, consider the unconditional probabilities of the three outcomes, {VER, ADD, free trade}. The probability of a VER obtained via the political process is equal to $(1-\beta)\pi$ while the anti-dumping process will yield a VER with probability $\beta\gamma$. The unconditional probability of a VER is:

$$(1.6) \quad \pi' = (1-\beta)\pi + \beta\gamma.$$

The unconditional probability of an ADD is

$$(1.7) \quad \beta' = \beta(1-\gamma).$$

Finally, the unconditional probability of free trade is:

$$(1.8) \quad 1 - \pi' - \beta' = (1-\pi)(1-\beta).$$

(1.6)-(1.8) are obtained by accumulating the probabilities on the decision tree. Each of the probabilities π' and β' is a function of Q^1, and Q^t. The latter however is also a function of Q^1.

Q^t is determined by profit maximizing exporters operating under a duty, the level of which depends on first period exports. With an anti-dumping duty, the level of the duty is assumed to be equal to

$$t = M(Q^1) - P(Q^1),$$

where the superscript 1 denotes the period 1 export. M(.) is the foreign firms' marginal cost.[14] The market equilibrium level of export sales in the event of a duty is:

$$(1.9) \quad Q^t = \phi(Q^1) = \{Q^t \mid P(Q^t) = M(Q^t) + M(Q^1) - P(Q^1)\}.$$

$$\phi_Q = \frac{dQ^t}{dQ^1} = -\frac{P_Q(Q^1) - M_Q(Q^1)}{P_Q(Q^t) - M_Q(Q^t)}.$$

[14]'Fair market value' in US trade law is equal to either average cost or price in the foreign market. Using marginal cost serves to tie the duty more closely to the behavior of the exporting firm, as in Anderson (1992). The simplification is relatively harmless.

ϕ_Q is less than zero: the greater is Q^1, the greater will be the anti-dumping duty, and hence the lower the tariff-ridden export Q^t. In the 'concave case', $P_{QQ} - M_{QQ} \leq 0$, $-\phi_Q \leq 1$.

Substituting (1.9) into (1.5), γ may be written as a function of Q^1:

$$(1.10)\quad \gamma(Q^1) = \frac{R(\bar{Q}) - R(\phi(Q^1))}{L_{max}}.$$

The elasticity of γ with respect to Q^1 is:

$$(1.11)\quad \frac{\gamma_Q Q^1}{\gamma} = \frac{\phi_Q}{\varepsilon^t \rho^t} \frac{Q^1}{Q^t} = \frac{\psi}{\varepsilon^t \rho^t} < 0.$$

Here, ρ^t is the increase in rent from the VER over the ADD relative to the ADD value of domestic output, $\frac{R(\bar{Q}) - R(\phi(Q^1))}{P(Q^t)Y^*(Q^t)}$; ε^t is the value of the import demand elasticity evaluated at Q^t; and ψ is the elasticity of Q^t with respect to Q^1. Intuitively, (1.11) implies that a rise in Q^1 lowers Q^t by raising the anti-dumping duty, hence it lowers the rent gain of the VER over the ADD. Rent seekers will spend less to get the VER, so γ falls.

I.2. Export Firms' Behavior

Exporting firms set Q^1 in equilibrium in order to maximize expected profits. The positive probability of a VER induces domino dumping in order to obtain options on export licenses in the event of a VER. Anderson (1992) shows that the equilibrium condition for competitive firms is:

$$(1.12)\quad -\left(P(Q^1) - M(Q^1)\right) = \lambda\pi'\left(P(\bar{Q}) - M(\bar{Q})\right) - \beta' M_Q(Q^1)\phi(Q^1).$$

Here, λ is the expected restriction ratio $\bar{Q}/Q^1$. The left hand side is the dumping margin (which also sets the ADD level, t). The competitive firms take P, λ, π' and β' as given. In contrast, the anti-dumping duty t is firm-specific in US trade law, so the firms internalize the marginal effect of current sales upon the expected future duty paid. This shows up in the second term on the right hand side of (1.12). The first term on the right hand side of (1.12), denoted V', is easily seen to be the option value of current sales. The term in brackets, $P(\bar{Q}) - M(\bar{Q})$, is the unit license rent, π' is the probability of obtaining a license, and λ is the rate of transformation of current sales into future claims to licenses in the event

of a VER. With some chance of an anti-dumping duty, the second term incorporates the expected second period duty-raising effect of increased exports in the first period.

The equilibrium of the model is the solution values of π',β', λ and Q^1 such that:

$$(1.12)\quad -\left(P(Q^1) - M(Q^1)\right) = \lambda\pi'\left(P(\bar{Q}) - M(\bar{Q})\right) - \beta' M_Q(Q^1)\phi(Q^1)$$

$$(1.13)\quad \pi' = (1-\beta)\frac{R(\bar{Q}) - R(Q^1)}{K_{max}} + \beta\frac{R(\bar{Q}) - R(\phi(Q^1))}{L_{max}}$$

$$(1.14)\quad \beta' = \beta\left(1 - \frac{R(\bar{Q}) - R(\phi(Q^1))}{L_{max}}\right)$$

$$(1.15)\quad \lambda = \frac{\bar{Q}}{Q^1}.$$

In solving the model, (1.13)-(1.15) are substituted into (1.12). An alternative arrangement of (1.12) is handy for exploring the equilibrium. The full marginal perceived revenue of current sales is equal to P+V', while the full marginal cost is equal to $M+M_QQ^t$. Full marginal cost is upward sloping due to the second order condition for the representative export firm. Full marginal revenue is downward sloping due to the influence of the first term, but tends to be upward sloping due to the influence of the second term. Perceived marginal revenue can slope upward if the effect of Q^1 on the probability of a VER, π', is positive and large enough.

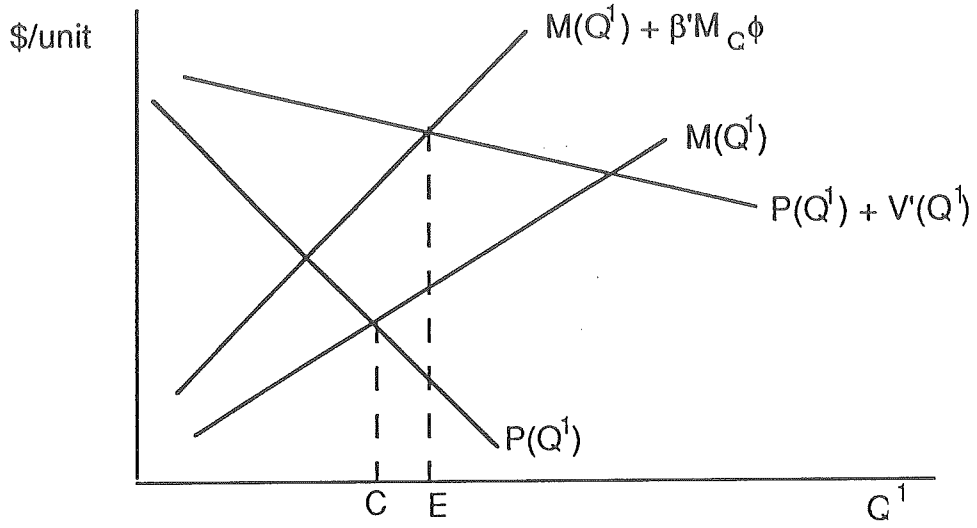
$$\frac{d(P+V')}{dQ^1} = P_Q - \frac{V'}{Q^1} + \frac{V'}{Q^1}\frac{\pi'_Q Q^1}{\pi'}.$$

Clearly, π'_QQ^1/π' must exceed one to permit a rising marginal revenue curve. For instability and multiple (or possibly no) equilibria to arise, π'_QQ^1/π' must exceed one by enough to drive d(P+V')/dQ positive in some region. The lesson is similar to that in the rational expectations macro literature: the feedback response of current actions to anticipated future actions is a source of instability and multiple equilibria. Here, the multiple equilibrium possibility formalizes a practical concern that some import markets seem vulnerable to "surges", where a tiny change in conditions produces a large discrete change in imports. The next section develops explicit expressions for the unconditional elasticity

of the probability of a VER. Appendix 1 shows that a rising full marginal revenue curve cannot be ruled out, but requires very strong conditions. In the remainder of the paper, stability is assumed.

Figure 1 illustrates the issues.

Figure 1. Determination of Q^1



E is the equilibrium volume of exports, which is larger than C, the no-dumping volume. As drawn, the full marginal revenue of exports remains downward sloping.

II Comparative Statics of Enforcement

Subsection II.1 considers the effect of β on trade volume Q^1. Subsection II.2 considers the effect of β on π', $1-\pi'-\beta'$ and β'.[15]

II.1 Trade Volume Derivatives

An increase in the level of enforcement of the anti–dumping legislation is associated with a rise in β. In Figure 1, at constant volume, the full marginal cost curve shifts upward. More interestingly, the full marginal revenue curve shifts up (down) if π' rises (falls). Differentiating (1.6) with respect to β, π' rises (falls) with β as $\gamma > (<)\pi$. Assuming the stability condition is met, Q^1 rises (falls) with β as

[15]For brevity, comparative static results on the other variables L_{max}, K_{max}, $\bar{Q}$ are not presented.

(2.1) $\lambda(\gamma - \pi)\left(\bar{P} - M(\bar{Q})\right) > (<) \quad (1-\gamma)M_Q(Q^1)Q^t.$

Clearly, $\gamma>\pi$ is necessary for the perverse case in which a rise in anti–dumping enforcement effort increases dumping. There is nothing implausible in this condition, as (1.5) and (1.3) reveal. Thus

Proposition 1 Anderson (1992)

(a) A rise in the anti–dumping enforcement level will raise the amount of dumping for a sufficiently large probability of an anti–dumping VER;

(b) A rise in the anti–dumping enforcement level will reduce the amount of dumping for $\gamma<\pi$.

Now consider whether anti–dumping enforcement can ever fully deter dumping. At β equal to zero, there necessarily is dumping, since the option value is positive. Then if Q^1 is increasing in β, it is impossible to deter dumping. For the 'normal' case where Q^1 is decreasing in β, note that the left hand side of (2.1) is decreasing in Q^1, since γ is decreasing in Q^1 by (1.11) and π is increasing in Q^1 by (1.4). Thus as β rises and the full marginal revenue curve shifts to the left, the rate of the shift falls. Eventually, γ-π will rise to zero. For a small country (M_Q=0) this means no further increases in β will reduce Q_1. But at $\gamma=\pi$, $\pi'=\pi$ and dumping still occurs, by (1.12). Formally:

Proposition 2

Anti-dumping enforcement can never fully deter dumping for a small country. For a large country, enforcement can fully deter dumping if trade responds normally to enforcement, provided the terms of trade effect is sufficiently strong.

Note that the argument here shows that rises in enforcement effort will eventually lead to the perverse situation where the probability of an anti-dumping VER exceeds the probability of a political VER. This may help explain why the increased anti-dumping enforcement activity of the 80s in the US coincided with an explosion of anti-dumping

VERs. (The uniform density assumption used to define the probability of a VER is inessential to the argument.)[16]

II.2 Probability Derivatives

A common rationale for 'fair trade' legislation is that it helps preserve a liberal trade order. It is thus important to consider the effect of enforcement parameters on the probability of a VER and on the probability of free trade.

The unconditional probability of a VER, π', rises or falls with Q^1 as

$$(2.2)\quad \frac{\pi'_Q Q^1}{\pi'} = \frac{\pi_Q Q^1}{\pi}\frac{(1-\beta)\pi}{\pi'} + \frac{\gamma_Q Q^1}{\gamma}\frac{\beta\gamma}{\pi'}$$

$$= \frac{1}{\varepsilon^1\rho^1}\frac{(1-\beta)\pi}{\pi'} + \frac{\phi_Q}{\varepsilon^t\rho^t}\frac{Q^1}{Q^t}\frac{\beta\gamma}{\pi'} \gtrless 0$$

using (1.4) and (1.8'). The 'normal' case is for the first term to dominate, hence for the probability of a VER to rise with Q^1. This is guaranteed at β equal to zero, but impossible at $\beta = 1$. Assuming that the trade volume responds normally to enforcement, at some critical level of enforcement effort, the switch over to a 'perverse' response of π' to Q^1 is guaranteed.

The effect of a rise in enforcement effort upon the unconditional probability of a VER is:

$$(2.3)\quad \frac{d\pi'}{d\beta} = (\gamma - \pi) + \pi'_Q\frac{\partial Q^1}{\partial\beta}.$$

The 'perverse' case is where the probability of a VER is increased by more anti-dumping enforcement. Then using (2.1), (2.2) and Proposition 1 in (2.3):

Proposition 3

The probability of a VER

(a) rises with initial enforcement if $\gamma > \pi$ and M_Q is sufficiently small,

(b) rises with enforcement if $\gamma > \pi$, M_Q is large, and β is sufficiently large.

Proof:

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16 The cumulative density in general depends on the endpoint of an integral defined by an index in which the rent gain exceeds a cost index. The key properties are that the rent gain under a VER exceeds the rent gain under an ADD, while the cost of political VER exceeds the cost of an anti-dumping VER.

(a) For M_Q sufficiently small, the sign of $\partial Q^1/\partial\beta$ is the sign of $\gamma-\pi$. Under the condition, π'_Q is positive and thus both terms of (2.6) are signed by $(\gamma-\pi)$.

(b) If M_Q is large, $\partial Q^1/\partial\beta \leq 0$ despite $\gamma>\pi$ from (2.1), and the proof requires showing that $(\pi'_Q Q/\pi')\partial Q^1/\partial\beta$ is negative. As β approaches 1, π'_Q must be negative. ||

Next, consider the implications of greater enforcement effort on the probability of free trade, $1 - \pi' - \beta'$.

$$(2.4)\quad \frac{d(1 - \pi' - \beta')}{d\beta} = -(1 - \pi) - (1-\beta)\left((\gamma - \pi) + \pi_Q \frac{\partial Q^1}{\partial \beta}\right).$$

The right hand side expression is obtained from noting $1-\pi'-\beta' = (1-\pi)(1-\beta)$, differentiating and using (2.3). The direct impact of anti-dumping enforcement cannot fail to reduce the probability of free trade. However, the indirect endogenous probability effect of enforcement raises the probability of free trade provided that enforcement does indeed reduce the volume of exports. Formally:

Proposition 4

(a) Greater enforcement reduces the probability of free trade if β is sufficiently large, or if γ is sufficiently large so that exports respond perversely to enforcement

(b) For a sufficiently high probability of a political VER, combined with normal response of exports to enforcement, greater enforcement raises the probability of free trade.

The common rationale for fair trade legislation is that it preserves liberal trade or alternately it reduces the probability of something worse, like a VER. Propositions 3 and 4 show that this is a fragile rationale, since the probability of a VER will rise with enforcement effort in two reasonable circumstances, and the probability of free trade can easily fall with enforcement.

Finally, the response of the unconditional probability of an anti-dumping duty to enforcement is equal to:

$$(2.5)\quad \frac{d\beta'}{d\beta} = (1-\gamma) - \beta\gamma_Q \frac{\partial Q^1}{\partial \beta}.$$

If exports respond normally to enforcement, the second term is negative, from (1.11), while the first is positive. At no initial enforcement, the first term dominates, but as enforcement effort rises, the second term can dominate. Thus the unconditional probability of an ADD can fall as enforcement rises.

III. The Welfare Effect of Anti-dumping Enforcement

It is arguable that the executive branch of the government maximizes a combination of consumers' and producers' surplus. At any rate, the effect of enforcement effort on the 'public interest' is a legitimate subject of analysis. Subsection III.1 develops the necessary welfare measures. Subsection III.2 presents the welfare analysis. As usual with second best policy, the relative strength of opposing effects matters. A sufficient condition is presented for a country to (perversely) gain from a small amount of anti-dumping enforcement.

III.1. The Welfare Measure

Expected welfare in the importing country is equal to the surplus in the first period plus the expected surplus in the second period plus the expected tariff revenue.[17] The cost of obtaining a VER is a transfer from rent seekers to politicians, hence it cancels in welfare.[18]

The social surplus associated with the level of sales Q is equal to:

$$(3.1) \qquad \int_0^{Y^*(Q)+Q} P(x)dx - \int_0^{Y^*(Q)} C_Y(y)dy - P(Y^*(Q)+Q)Q,$$

where P(.) is the inverse demand function, the first term is the total area under the demand curve, the second term is the total cost of the mobile factors, and the third term is the cost of the imports. Social surplus is also written using (3.1) as

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[17]The 2 period model abstracts from a potentially significant complication of the multiperiod reality. Anti-dumping duties are temporary, while VERs are permanent, a feature which cannot emerge with only one future period. In US trade law, ADDs are reviewed annually, and removed if dumping has ceased. VERs in contrast generally persist. The simplification of the text turns out to be harmless, however, since an unpublished Appendix, available from the author upon request, shows that the qualitative results are unaltered in a multiperiod model with temporary ADDs and permanent VERs.

[18]Allowing some portion of the cost to reflect real resources used in rent-seeking adds a loss term to the welfare function which is proportional to the expected rent gain, hence it introduces no new qualitative features. See section IV for a treatement of the expected net rent gain.

$$(3.2)\quad S(Q) = \int_0^{Y^*(Q)+Q} P(x)dx + R(Q) - P(Y^*(Q)+Q)[Y^*(Q)+Q].$$

The effect of a marginal change in Q upon social surplus S is equal to:

$$(3.3)\quad S_Q = -QP_Q,$$

using (1.2), where P_Q is equal to $\frac{dP}{d(Q+Y^*)}[1 + Y^*_Q]$. Henceforth, as before, P(Q) replaces the more cumbersome P(Y*(Q)+Q).

The tariff revenue collected in period 2 in the event of a duty is

$$(3.4)\quad G(Q^1) = \big(M(Q^1) - P(Q^1)\big)\phi(Q^1).$$

The expected welfare over two periods is the surplus in the first period plus the sum of the expected surplus and the expected tariff revenue in the second period. The surplus in the first period is equal to $S(Q^1)$. The expected surplus in the second period is equal to

$$\pi'S(\bar{Q}) + \beta'S(\phi(Q^1)) + (1 - \pi' - \beta')S(Q^1).$$

Here, if no intervention is made, the equilibrium level of exports is again set equal to Q^1. The expected two period welfare is:

$$W = S(Q^1) + \pi'S(\bar{Q}) + \beta'S(\phi(Q^1)) + (1 - \pi' - \beta')S(Q^1) + \beta'G(Q^1).$$

This is more usefully rearranged as:

$$(3.5)\quad W = S(Q^1) + \big(\pi'S(\bar{Q}) + (1-\pi')S(Q^1)\big) + \beta'T(Q^1),$$

where T is equal to the dead weight loss associated with levying the anti-dumping duty:

$$T(Q^1) = S(\phi(Q^1)) - S(Q^1) + \phi(Q^1)\big(M(Q^1) - P(Q^1)\big).$$

T is negative for a small country (M_Q=0) and may be positive for a large country.

III.2 . The Welfare Effect of Enforcement

The executive's problem when acting in the public interest is to manipulate β so as to increase W, acting directly on W and indirectly through the response of Q^1. A rise in enforcement effort changes welfare by, differentiating (3.5) and rearranging:

$$(3.6)\quad \frac{\partial W}{\partial \beta} = (2 - \pi')S_Q(Q^1)\frac{\partial Q^1}{\partial \beta} + \beta'T_Q(Q^1)\frac{\partial Q^1}{\partial \beta} - \big(S(Q^1) - S(\bar{Q})\big)\frac{d\pi'}{d\beta} + T(Q^1)\frac{d\beta'}{d\beta}.$$

The first term on the right hand side represents the current surplus loss due to reduced dumping (when $\partial Q^1/\partial\beta < 0$). $S_Q>0$, so this term is negative. The second term is the expected gain from a lower anti-dumping duty. T_Q can have either sign. The two terms together are the volume effect of enforcement. The second line is the probability effect of enforcement. It gives the expected surplus gain due to the shift of probability mass among the alternatives of the VER and the ADD. The first term is equal to the gain due to a shift from the VER to free trade when $d\pi'/d\beta < 0$. The second term of the second line is the expected loss due to a larger probability of an anti-dumping duty when $d\beta'/d\beta$ is positive. This term reduces welfare when the terms of trade effect is small, $T<0$. Considering all terms together, as usual with second-best problems, enforcement may or may not be welfare-improving.

One case of each response is provided. The 'free parameters' include K_{max}, L_{max}, M_Q, P_Q and shift parameters for marginal domestic cost, C_Y, as well as M and P. The free parameters can be set such that at β equal to zero, the equilibrium Q^1 implies a number of conditions.

Proposition 5

(a) If (i) $\gamma=\pi$, (ii) $T > 0$, and (iii) $\pi > 2\frac{Q}{Y+Q}$, a small enforcement effort is welfare improving.

(b) If exports respond normally to enforcement and (i) $\gamma\geq\pi$, (ii) $T<0$, and (iii) $\pi < 2\frac{Q}{Q+Ys}$ for some $s>1$, a small enforcement effort is welfare decreasing.

Proof: see Appendix 2.

It is also worth noting that full enforcement of anti-dumping laws is often costly.

Proposition 6

If Q^1 responds normally to enforcement:

(a) a reduction from maximum interior enforcement levels is welfare-improving if $T<0$,

(b) a reduction from prohibitive enforcement levels is welfare-improving in the concave case.

Proof: See Appendix 2.

Propositions 5 and 6 show that welfare–increasing enforcement of anti–dumping laws is possible. The outcome hangs on the balance of two terms, the volume effect and the probability effect. A clear ranking is possible only in special cases. Also, full enforcement of anti–dumping laws, even if feasible, is often not optimal. Simulation may provide a useful guide here in the future. Based on my limited simulation of a constant elasticity model, welfare–decreasing enforcement is the norm.

IV. The Rent Effect of Anti-dumping Enforcement

It seems obvious that rent-seekers would prefer more enforcement: i.e., expected rent rises with enforcement effort from $\beta=0$ to $\beta=1$. Instead, it is possible for rent to fall with enforcement. One example of each direction of change is provided.

Expected gross rent in period 2 is equal to $\pi' R(\bar{Q}) + \beta' R(Q^t) + (1-\pi'-\beta')R(Q^1)$. The net rent gain is obtained by deducting the expected cost of obtaining VERs. The expected cost of a political VER given the decision to obtain one is equal to $[R(\bar{Q}) - R(Q^1)]/2$, due to the uniform density function for lobbying costs. The conditional expected cost of an anti-dumping VER is similarly equal to $[R(\bar{Q}) - R(Q^t)]/2$. The unconditional expected lobbying costs from both sources is equal to $(1-\beta)\pi[R(\bar{Q}) - R(Q^1)]/2 + \beta\gamma[R(\bar{Q}) - R(Q^t)]/2$. In addition, rent in period 1 is altered by

the effect of enforcement on exports in period 1. The expected present value of net rent over the 2 periods is equal to:[19]

$$(4.1)\quad NR = \pi'(Q^1)\frac{R(\bar{Q}) - R(Q^1)}{2} + \beta\left(1-\gamma(Q^1)/2\right)\left(R(\bar{Q}) - R(\phi(Q^1))\right) + 2R(Q^1).$$

The effect of a rise in the enforcement probability on the expected net rent is obtained by differentiating (4.1) with respect to β and using the comparative static derivatives of Section II. Evaluating at β equal to zero:

$$(4.2)\quad \frac{\partial NR}{\partial \beta}\Big|_{\beta=0} = \frac{1}{2}[R(\bar{Q}) - R(Q^1)]\pi_Q\frac{\partial Q^1}{\partial \beta} + \frac{\gamma-\pi}{2}[R(\bar{Q}) - R(Q^1)] + (1-\gamma/2)[R(Q^t)-R(Q^1)] + (2-\pi/2)R_Q\frac{\partial Q^1}{\partial \beta}.$$

Note that $[R(\bar{Q}) - R(Q^1)]\pi_Q = -\pi R_Q$, from (1.2) and (1.4). Substituting into (4.2),

$$(4.2')\quad 2\frac{\partial NR}{\partial \beta}\Big|_{\beta=0} = (2-\pi)R_Q\frac{\partial Q^1}{\partial \beta} + \frac{\gamma-\pi}{2}[R(\bar{Q}) - R(Q^1)] + (1-\gamma/2)[R(Q^t)-R(Q^1)].$$

Two special cases follow immediately.

Proposition 7

(a) If $\gamma=\pi$, a small amount of enforcement increases expected net rent.

(b) If $\gamma>0$, $\pi = 0$ and exports respond perversely to enforcement, a small amount of enforcement reduces expected net rent provided the rent level under theVER is less than triple the rent with no intervention.

V. Conclusion

The political economy model of anti-dumping presented here seems worth extending in a number of directions. First, the simple model here rationalizes a number of characteristics of the recent explosion of anti-dumping activity, and should be empirically testable. In empirical implementation, the lobbying cost K_{max} or L_{max} would be replaced

[19] Add together expected gross rent in period 2, expected unconditional lobbying cost, and $R(Q^1)$. Then add and subtract $[R(\bar{Q}) - R(Q^1)]\gamma\beta/2$, and collect like terms.

by a set of predictors reflecting political economy factors, such as political structure, recession, the presence of VERs in similar industries, and the like. The particular simple form of the probability of a VER arises from the uniform distribution assumption for lobbying costs, which should be replaced with one of the standard distribution assumptions in the dichotomous choice literature, such as the logistic or the normal distribution.

Second, the elements isolated here should be important in a variety of extended models which include significant complicating factors, such as imperfectly competitive firms, and activist governments on both sides of the market.

Third, it should be useful to build a deeper model of the political economy of the executive. Here, links may emerge between the enforcement effort, the level of the VER and the cost of lobbying. Moreover, with a richer political economy structure, multi-commodity aspects of the problem must be studied, including the use of enforcement to open export markets. It might also be possible to adapt the model to different national government structures.

Finally, based on a multi-commodity model of two activist governments, it will be possible to analyze the benefit of anti-dumping codes, such as are currently discussed in GATT negotiations.

Appendix 1. Stability of Equilibrium

Instability and multiple equilibria are possible if $\pi'_Q Q^1/\pi'$ is large enough, as discussed in Section I. The condition for the full marginal revenue of exports P+V' to increase in Q is:

$$P_Q - \frac{V'}{Q^1}\left(1 - \frac{\pi'_Q Q^1}{\pi'}\right) > 0, \text{ or}$$

$$-1 + \frac{\pi'_Q Q^1}{\pi'} > -\frac{Q^1 P_Q}{V'}.$$

This may be rewritten using (2.2) as

$$\frac{(1-\beta)\pi}{\pi'} > \rho^1\varepsilon^1 + \rho^1\frac{P}{V'} - \frac{\beta\gamma}{\pi'}\phi_Q\frac{\rho^1}{\rho^t}\frac{\varepsilon^1}{\varepsilon^t}\frac{Q^1}{Q^t}.$$

All the terms on the right are non-negative. Reducing β to zero makes the condition easier to meet (leaving aside the endogenous effect on Q^1). The requirement is then

$$1 > \rho^1\varepsilon^1 + \rho^1\frac{P}{V'} = \rho^1\varepsilon^1 + \frac{K_{max}/Y^*}{\lambda\left(P(\bar{Q}) - M(\bar{Q})\right)}.$$

A necessary condition is $\bar{Q}\left(P(\bar{Q}) - M(\bar{Q})\right) > K_{max}\frac{Q^1}{Y^*}$. That is, the quota rent exceeds the import share times the *maximal* domestic rent per unit of domestic sales, where maximal means a value large enough to make a VER certain. Under symmetry, the foreign and *actual* domestic rent gains would be in proportion to market share. The interesting equilibria of the model are where the actual domestic rent gain is less than the maximal value. It is quite possible that the actual domestic rent gain is more than in proportion to current market share. It seems rather unlikely, however, that the foreign rent is more than in current market share proportion to the maximal domestic rent. To say more requires a model of the bargaining process by which the VER is set.

Appendix 2. Proofs of Propositions

Proof of Proposition 5:

(a) At $\beta=0$ and $T>0$,

$$\frac{\partial W}{\partial \beta} > (2-\pi')S_Q(Q^1)\frac{\partial Q^1}{\partial \beta} - \left(S(Q^1)-S(\bar{Q})\right)\frac{d\pi'}{d\beta}$$

At $\gamma=\pi$, $d\pi'/d\beta = \pi_Q \partial Q^1/\partial\beta$, from (2.2) and (2.3). Also, $\partial Q^1/\partial\beta < 0$. Then welfare is increasing in β if

$$(2-\pi)S_Q - \left(S(Q^1)-S(\bar{Q})\right)\pi_Q < 0.$$

Using (1.4) to substitute for π_Q and (3.3) to substitute for S_Q, and dividing through by $-P_Q Q^1$, the condition is

$$(2-\pi) - \pi\frac{Y}{Q^1}\frac{S(Q^1)-S(\bar{Q})}{R(\bar{Q})-R(Q^1)} < 0.$$

From (3.2), note that the ratio of the change in S to the change in R exceeds one. Then the condition is met if $(2-\pi) < \pi Y/Q^1$, or

$$\pi > 2\frac{Q}{Y+Q}.$$

(b) For $\gamma\geq\pi$, $\partial Q^1/\partial\beta<0$ and $T\leq 0$, using the same chain of reasoning as in (a), welfare is decreasing in β if

$$(2-\pi) - \pi\frac{Y}{Q^1}\frac{S(Q^1)-S(\bar{Q})}{R(\bar{Q})-R(Q^1)} > 0.$$

The ratio of the change in S to the change in R is equal to s, which is greater than one. Then the condition is met if $\pi < 2Q/(Q+Ys)$. ||

Proof of Proposition 6:

(a) If an interior maximum is found, $\partial Q^1/\partial\beta = 0$ and $\gamma\geq\pi$ from the argument for Proposition 2. The volume effect = 0 since $\partial Q^1/\partial\beta = 0$. For the probability effect, from (2.3), $d\pi'/d\beta = \gamma-\pi > 0$. From (2.5), $d\beta'/d\beta = 1-\gamma > 0$. For $T<0$, the probability effect must be negative. Then a reduction in β is welfare-increasing.

(b) At $\beta = 1$, with Q^1 driven to the no-dumping level, the volume effect is negative. To achieve the no-dumping level, $\partial Q^1 \partial \beta < 0$. Then the first term of the volume effect is negative. The second term of the volume effect is negative if $T_Q > 0$. Generally,

$$T_Q = S_Q(Q^t)\phi_Q - S_Q(Q^1) + \phi_Q t + Q^t M_Q(Q^1) - Q^t P_Q(Q^1).$$

At the no-dumping point, $t=0$, $Q^t = Q^1$ and $T_Q = S_Q(\phi_Q+1) + Q^1(M_Q - P_Q) > 0$ if $-\phi_Q \leq 1$. From (1.9), $-\phi_Q \leq 1$ in the concave case, $P_{QQ}-M_{QQ}<0$.

As for the probability effect, note that $T = 0$. Moreover, at $\beta=1$, $d\pi'/d\beta > 0$. $\partial W/\partial \beta < 0$, and a reduction in β improves welfare. ||

Proof of Proposition 7:

(a) Under the condition, exports respond normally, the middle term is zero and the last term is positive.

(b) At $\pi=\beta=0$ there is initially no dumping, so $Q^t = Q^1$. The right hand side of (4.2') reduces to (-) $+ R(\bar{Q})\gamma/2 - (1+\gamma/2)R(Q^1)$. The second and third terms together are negative if $\gamma < 3R(Q^1)/R(\bar{Q})$, which always holds if $3R(Q^1)>R(\bar{Q})$. ||

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