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"On the Best Use of Trade Controls in the Presence of Foreign Market Power"

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3/83

ABSTRACT

Tower, E. ON THE BEST USE OF TRADE CONTROLS IN THE PRESENCE OF FOREIGN MARKET POWER.

This paper derives optimum tariffs for a country whose trading partner always exploits its own market power but assumes naively that the home country will leave its restriction unchanged. It then shows that a country which is a monopolist or monopsonist will always prefer its best price limit (price floor or ceiling) to its best tariff and prefer free trade to any quota. However, a duopsonist or duopolist will prefer its best quota to its best tariff and free trade to any price limit. Finally, the best import or export tariff of a country which fears retaliation may be negative.

Duke University

ON THE BEST USE OF TRADE CONTROLS IN THE PRESENCE OF FOREIGN MARKET POWER

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*This paper was stimulated by and is designed to explore further the issues raised by Jacob Dryer (1979) who has written (p. 319) "While it is not true that retaliation is beneficial to the retaliating country under all circumstances, it is clear that on some occasions countervailing policies may limit the damage to national interests of the offended country. It ought to be recognized, however, that policies designed to countervail foreign use of monopoly power may result in further departures from the free trade arrangement and therefore may become a source of further distortions in the national economies concerned and in the world economy as a whole." D. L. Allen, J. N. Bhagwati, J. S. Chipman, M. M. Courtney, R. Falvey, D. H. Feldman, H. Fried, M. C. Kemp, and T. D. Willett made valuable comments as did participants in seminars at Penn, Iowa State, Auckland, Victoria University of Wellington and Massay University. Parts of the paper were written at the University of Auckland, Claremont McKenna College and Claremont Graduate School.

1. Introduction and conclusion

When a government faces price takers at home and abroad, ad valorem and specific tariffs, quotas, and price limits (i.e., price floors and ceilings) can all be imposed as devices to increase domestic welfare by manipulating the terms of trade. Moreover, all of these instruments are equivalent in that the equilibrium brought about by a level of one restriction can be duplicated by setting any other restriction at the appropriate level.[1] However, when a seller faces a duopolistic rival or a monopsonistic buyer or when a buyer faces a duopsonistic rival or a monopolistic seller, the equivalence between the various instruments breaks down. In this paper we determine the best use of each of the instruments and rank them according to their efficacy for each of the market structures.

Throughout the paper we assume that the market structure within the home country (country 1) is competitive, and that the other non-price-taker (country 2) either has a competitive market structure and uses trade controls to manipulate price or else has a state trading authority which makes decisions to the same purpose. We also suppose that the level of country 1's trade restriction is taken as given by its rival or trading partner who maximizes its own welfare subject to what it perceives as the exogenously determined level of the restriction. Thus, country 1 is a Stackelberg policy leader, who searches for the optimal instrument and the best use of it to exploit its market power, while the partner or rival is a Stackelberg follower.[2]

Our intuitively appealing conclusion is that a monopolist or a monopsonist will wish to present its trading partner with as elastic an effective supply or

demand curve as possible to rob that partner of as much market power as possible, and thereby encourage that partner to expand its participation in the market. Hence, such a country will find the best price floor or ceiling to be preferable to the best tariff, which in turn will be preferable to the best quota.[3] Throughout the paper we refer to the level of the restriction which maximizes a country's welfare in the presence of imperfect competition abroad as the *best* tariff, quota or price limit to distinguish it from the *optimum* tariff, quota or price limit which assumes price taking behaviour everywhere.

More specifically, in Section 2 we establish

Proposition 1: From the standpoint of the seller in bilateral monopoly (restricting our attention to non-negative tariffs), the best price floor $\geq$ *the best specific tariff* $\succ$ *the best ad valorem tariff* $\succ$ *free trade* $\succ$ *any binding quota where "*$\succ$*" means "is preferred to" and "*$\succeq$*" means "is preferred or indifferent to."* Thus, there will always be some price floor which is preferable to free trade and there may be an ad valorem or specific tariff which is preferable to free trade, but free trade will always be preferable to any binding quota.

Then in Section 3, we note

Proposition 2: From the standpoint of the buyer in bilateral monopoly (again restricting our attention to non-negative tariffs), the best price ceiling $\geq$ *the best ad valorem tariff* $\succ$ *the best specific tariff* $\succ$ *free trade* $\succ$ *any binding quota.* Interestingly enough, in these cases a price floor or ceiling can be used to achieve Pareto optimality in the world economy, for

as even the reader of Lipsey and Steiner (1975, p. 390) knows, price floors and ceilings can be used to move an imperfectly competitive system to Pareto optimality.

However, a duopolist or duopsonist, i.e., a market participant who must compete with a non-price-taking rival, will be more successful when it uses an instrument which makes its own excess supply or demand less elastic, thereby making its rival face a less elastic excess demand or supply. This will encourage that rival to *contract* its own participation in the market, thereby leaving more of the market for the first duopolist. Thus for a duopolist or a duopsonist, the best quota will be preferable to the best tariff which in turn will be preferable to the best price floor or ceiling.

More specifically, in Section 4 we discuss the logic which leads to *Proposition 3: For a duopolist with an imperfectly elastic supply curve the best quota* $\succeq$ *the best ad valorem tariff* $\succeq$ *the best specific tariff* $\succeq$ *the best price floor* $\succeq$ *free trade.* The analysis for a duopsonist is analogous, so we simply note

Proposition 4: For a duopsonist with an imperfectly elastic demand curve the best quota $\succeq$ *the best specific tariff* $\succeq$ *the best ad valorem tariff* $\succeq$ *the best price ceiling* $\succeq$ *free trade.*

These latter two propositions are exceptions (in addition to those found by McCulloch (1973)) to the rule that in the presence of imperfect competition, tariffs are superior to quotas. Moreover, these four

propositions reaffirm the adage that anything a tariff can do, something else can do better: for a monopolist or monopsonist that something else is a price floor or ceiling and for a duopolist or a duopsonist that something else is a quota. Finally, as Corden (1965) notes, in each case there is an explicit transfer combined with free trade by both countries which would be better for both countries than any of these policies.

We also derive the appropriate levels of trade restrictions geometrically under all four types of market structure, which leads us to propositions 5 and 6:

Proposition 5: The best level of trade for a buyer or seller in bilateral monopoly or for a duopolist or duopsonist is determined by the intersection of his own demand or supply curve with the curve which is marginal to the foreign reaction curve drawn for the particular type of restriction (tariff, quota, or limit to price movement) being considered. Expressing the same idea mathematically, the proportional difference between the domestic and the world price which he should maintain (i.e., the ad valorem equivalent of his best trade restriction) is given by the standard formula for the optimum import or export tariff when the elasticity of foreign supply or demand is replaced by the elasticity of the foreign reaction curve.[4]

Proposition 6: When the trading partner of a buyer or seller ceases to be a price taker to become an imperfect competitior, the appropriate price ceiling of the buyer or price floor of the seller is unchanged, because such floors and ceilings present the foreigner with a perfectly elastic demand or supply, thereby robbing him of any meaningful monopoly or monopsony power. Therefore, in this circumstance, the reaction curve coincides with the foreign supply or demand curve in the relevant range, so the best differential between the domestic and world price will be given by the standard formula for the optimum import or export tariff. However, the

adoption of price setting behaviour by a trading partner may cause the appropriate ad valorem or specific tariff to rise or fall, and (from Propositions 1 and 2) the best quota is non-binding.

Thus, if the instrument of protection is a price floor or ceiling, imperfect competition abroad does not constitute an argument for protection which is logically distinct from the standard optimum tariff argument. But if a tariff is used as the instrument, imperfectly competitive behaviour by a trading partner must be reckoned with, but it may cut in either direction, i.e., the best ad valorem or specific tariff may lie above or below the optimum one and such foreign behaviour should always cause any quota to be scrapped.

In section 5 we establish

Proposition 7: Under bilateral monopoly the best ad valorem or specific import or export tariff may be negative. Thus we have yet another reason besides these given by Kemp (1967) for why the "optimum" tariff may be negative.

The remaining propositions are yielded by the calculus in the appendix which relates to the best ad valorem export tax, and three additional appendices (available upon request) which contain similar calculus relating to the other three cases.

Proposition 8: Under bilateral monopoly, the best ad valorem export tariff is:

$$a^* = \frac{1}{\frac{\eta}{1 + \frac{\eta}{\sigma}\left[\frac{\sigma\ (1+\theta)\ -1}{\sigma + 1}\right]} - 1} \qquad \text{(I)}$$

and the ad valorem equivalent of the best specific export tariff is

$$s_a^* = \frac{1 + [1+\eta(1+\theta)]/\sigma}{\eta - 1} \qquad \text{(II)}$$

where both tariffs are expressed as proportions of the domestic price, η *is the elasticity of the foreign private sector's excess demand* ($\eta > 0$), σ *is the elasticity of the domestic private sector's excess supply and* θ *is the curvature of the domestic private sector's excess supply (defined as the percentage change in slope per percentage change in quantity supplied, being 0 when the domestic supply curve is linear).*

Note that when $\sigma \to \infty$, so the foreigner can exert no monopoly power, these expressions reduce to the familiar formula $(1 / [\eta - 1])$ for the optimum export tariff.

Proposition 9: Under bilateral monopoly, the best ad valorem import tariff is

$$a^* = \frac{1}{\sigma} + \frac{1+\phi+(1/\eta)}{\eta-1} \qquad \text{(III)}$$

and the ad valorem equivalent of the best specific import tariff is

$$s_a^* = \frac{(1/\sigma) + [1+\phi-(1/\sigma)]/\eta}{1-[1+\phi-(1/\sigma)]/\eta} \qquad \text{(IV)}$$

where both tariffs are expressed as proportions of the world price, η *is the elasticity of the domestic private sector's excess demand* ($\eta > 0$), ϕ *is the curvature of the domestic private sector's excess demand (defined as the percentage change in slope per percentage change in quantity demanded, being 0 when the domestic demand curve is linear) and* σ *is the elasticity of the foreign private sector's excess supply.* Note that when $\eta \to \infty$, so the foreigner can exert no monopoly power, these expressions reduce to the familiar optimum import tariff $(1/\sigma)$ provided in Johnson (1971, 170) and elsewhere.

Proposition 10: If the domestic supply curve is linear and the foreign market is monopsonized, (A) the imposition of a small ad valorem export tariff

will necessarily raise domestic welfare if the domestic supply curve is elastic (eq. 16), and (B) the imposition of a small specific export tariff will always raise domestic welfare.

Proposition 11: If the foreign market is monopsonized and in the relevant range the elasticity of foreign demand is constant and the domestic supply curve is linear, (A) a small increase in the domestic ad valorem export tariff above the traditional optimum level will raise domestic welfare if and only if the supply of domestic output is elastic at the equilibrium the foreign monopsonist selects (eq. 17), and (B) a small increase in the domestic specific export tariff above the traditional optimum level will always raise domestic welfare.

Proposition 12: If the domestic demand curve is linear and the foreign market is monopolized, the imposition of either a small (A) ad valorem or (B) specific import tariff will always raise domestic welfare.

Proposition 12: If the foreign market is monopolized and in the relevant range the elasticity of foreign supply is constant and the domestic demand curve is linear, (A) a small increase in the domestic ad valorem import tariff above the traditional optimum level will always raise domestic welfare, and (B) a small increase in the domestic specific import tariff above the traditional optimum level will raise domestic welfare if and only if the supply of foreign output is elastic.

The demonstration of these propositions plus the geometric derivation of appropriate trade restrictions under the various market structures constitute the paper.

2. Bilateral monopoly from the standpoint of the seller.

2.1. Perfectly elastic foreign demand.

In order to analyze bilateral monopoly from the standpoint of the seller, we start with a preposterously simple case in this section, whose only virtues are that it is easy to analyze and that it illustrates certain important points. Then we deal with the problem more generally.

Figure 1 illustrates the supply and demand curves for widgets, where S is the supply curve of the lone supplying country (drawn as a straight

line with a vertical intercept, 0) and D is the demand curve of the lone buying country, which is assumed to be perfectly elastic. When the buyer acts like a monopsonist and the seller is a free trader, the buyer will construct ME, the marginal expenditure curve drawn to S, and buy a quantity, W_f, determined by the intersection of ME with D at I; he will pay a price, p_f, which is the height of the point on S which lies directly below I. Since ME bisects ZE, F bisects OE. Thus under free trade the seller will acquire producer's surplus[5] of OFF'.

Now let us look at the same situation from a different vantage point. Since the demand is perfectly elastic, the demander's trade indifference curves in price - quantity coordinates can be drawn as rectangular hyperbolae with Z as the origin. These are curves showing equal amounts of consumer's surplus. The demander will select a price - quantity combination where the effective supply curve (i.e., the supply curve as perceived by the demander after it has been distorted by the supplier's tariff, quota or price floor) touches the indifference curve with the highest level of utility attached. When the supplier is a free trader, this tangency will lie at F, directly underneath the intersection of the demand curve with the ME drawn to S.

An export quota, W_f, causes the effective supply curve (i.e., the supply curve as perceived by the foreigner) to be given by OFI. Along this curve, buyer's welfare is highest at F, since there can be no tangency between 0 and F or between F and I. Thus, to be binding, an export quota must move the sales point to some point Q on OF to the south-west of F. Hence, OF is the locus of points attainable by the supplier as the quota is varied from the prohibitive to the non-binding level, and R_q, the buyer's reaction curve for quotas imposed by the seller, is also given by OF. Since producer's surplus will always be less at Q than at F, our seller will never find it advantageous to impose a binding quota.

Since all effective supply curves which are distorted by specific export tariffs will lie above the supply curve by a constant amount, in this case they will always be parallel to OE and lie above it. Therefore, the straight line ZF will be R_s, the demander's reaction function for specific export tariffs. The seller can maximize with respect to it by drawing MR_s, the marginal revenue curve to ZF; and the best specific export tariff is T_s, which is the vertical distance between MR_s and ZF where S intersects MR_s. Thus the ad valorem equivalent of the best specific tariff will be given by the standard formula for the optimum tariff $1/[\eta-1]$, where η, the elasticity, refers to the elasticity of the reaction function and is defined to be positive.

Supply curves when distorted by ad valorem tariffs are straight lines lying above S and passing through O. Thus indifference curves will be tangent to them midway between O and where they intersect D. Hence, the horizontal line FF' is R_a, the foreign reaction curve for ad valorem tariffs, and the best ad valorem tariff is clearly zero.[6]

If the exporter sets a price floor of p_f, his effective supply curve becomes F'FE and the foreigner will opt to trade at F. As the price floor is gradually raised to OZ, the trading equilibrium chosen by the foreigner will move along FE from F to E. Obviously, the best price floor will be infinitestimally less than OZ, and this choice of price floor enables the supplier to achieve producer's surplus approaching ZOE. In this example, it is clear that from the standpoint of the seller $E \succ T \{ F \succ$ any point other than F on R_a or R_q. Thus from the standpoint of our seller, the best price floor $\succ$ the best specific tariff $\{$ free trade $\succ$ the best positive ad valorem tariff or any binding quota; and this ranking is consistent with Proposition 1.

2.2 Positively sloped foreign demand

In the general case shown in figure 2, country 2's indifference curves will have zero slope where they cross D, and will be positively sloped to the left of D and negatively sloped to the right of D. If D is linear, they will also be homothetic with respect to Z. F is the equilibrium when country 1 is a free trader, and one of 2's indifference curves is tangent to S at F. The foreign reaction curve for a quota, R_q, is OF; for the price floor it is R_L, which is given by Zp_eF; for the specific tariff it is R_s which is given by ZF (a straight line if D and S are linear, due to homotheticity of the indifference curves in that case); for the ad valorem tariff it is R_a, given by F'F (where F' is the midpoint of OZ, O being the vertical intercept of S) and (as a bit of calculus shows) R_a is a straight line if D and S are straight lines. As in figure 1, the best level of whatever restriction is being considered is that which generates an import level defined by the intersection of the curve which is marginal to the relevant buyer's reaction curve with the home supply curve. Thus, the best ad valorem tariff or the ad valorem equivalent of the best price floor or the best specific tariff is $1/[\eta-1]$ where η refers to the elasticity of R_a, R_L or R_s respectively at the quantity where the curve marginal to the relevant reaction curve intersects the supply curve (Proposition 5).

2.3 Ranking

Now we are ready to derive Proposition 1. We suppose that the supply curve is not flat. Even if the supply curve in figure 2 had not been linear, it is clear that F is preferred to any other point on R_q (which is OF). Therefore, free trade is preferred to any binding quota. That the best ad valorem tariff may be positive

or zero, follows from the two figures. In Figure 1 free trade is better, while in Figure 2 a small ad valorem tariff is better. That the best positive specific tariff is superior to the best positive ad valorem tariff is obvious from the fact that to any point on R_a, there corresponds at least one point on R_s to the north-east of it. For a rigorous general proof of this fact, suppose that an ad valorem tariff has caused the equilibrium to settle at some point A in Figure 2, where tne effective supply curve is tangent to an indifference curve. Suppose this tariff is replaced with a specific one which causes the new effective supply curve to also pass through this same point. Then the new effective supply curve will lie above the old one to the left of A and below it to the right. Thus under this specific tariff, the foreigner will select a new trading point on R_s to the north-east of A and above S, call it A', which will be preferred by the seller to A. However, so long as the supply curve is not flat, A' will lie to the south-west of some point on R_L. Thus for any specific tariff, there will always exist a price floor which is preferable to it.

Finally, we need to prove that there exists a situation in which any specific tariff is inferior to free trade. Suppose that the home supply curve is given by OHFBB' in Figure 1. Suppose further that the foreigner has a lexicographic preference function ——————→ according to which its first objective is to maximize its own welfare, but its subsidiary objective is to maximize its trading partner's welfare so long as doing so does not reduce its own. In that case, with the seller being a free trader, the buyer will choose to buy that price-quantity combination given by B. Since the indifference curves are rectangular hyperbolae about Z, at each quantity, W, the slope of any indifference curve above I*, the one passing through F, must be less than that of I*. Thus a specific tariff which shifts up the supply curve uniformly will cause foreign welfare to be maximized when

H or less units are purchased. Clearly, if B and B' lie far enough to the right and H is sufficiently close to W_f', producer's surplus when the exporter is a free trader is greater than it is under any specific tariff. Thus we have proven Proposition 1.

2.4 A tariff to countervail monopsony power

The terms of trade argument for a tariff is well known, but occasionally, as Dryer (1979) points out, one hears the argument that foreign state trading or imperfect competition abroad means that the tariff should be raised in order to cope with it. Let us assess the truth of this argument by first examining specific, and then ad valorem tariffs.

Consider the situation depicted in Figure 1, where OE is the supply curve once again but now suppose that the demand curve becomes vertical at C which lies to the left of F, where TG is part of the supply curve when it is distorted by the best specific tariff. The optimum tariff is that which causes the tariff-distorted supply curve to pass through C. In this case, the best tariff lies below the optimum one, but this result is reversed when C lies to the right of G. Thus *the best specific tariff in the presence of foreign monopsony may lie above or below the optimum one.*

Imagine Figure 1 to be redrawn with the vertical intercept of the supply curve, p_i, corresponding to a very high price. Then denoting the vertical coordinate of Z by p_z, if $(p_z - p_i)/p_i$ is small enough, changes in the ad valorem tariff which cause the effective supply curve to pass through Zp_i will cause essentially parallel shifts in the tariff-distorted supply curve, so in the range of prices between p_i and p_z there will be virtually no difference between the effects of ad valorem and specific tariffs. Since the best and optimum specific tariffs can't be ranked in Figure 1 it stands to reason that the same is true for

ad valorem tariffs in this imaginary figure. This establishes the part of Proposition 6 which refers to a seller's tariff.

3. Bilateral monopoly from the standpoint of the buyer

The corresponding arguments for a monopsonist are constructed very similarly. A specific tariff shifts the demand curve as perceived by the supplier downward in a parallel fashion, and an ad valorem tariff pivots it downward by rotating it through the point where it intersects the horizontal axis. Using the same techniques as presented in the previous sections it is possible to derive Proposition 2.[7]

Moreover, it is easy to construct the reaction functions for the supplier when the marginal cost of production is zero, since his indifference curves will be rectangular hyperbolae drawn about the origin. In this case the reaction function for the specific tariff is a straight line passing through the origin and F, the midpoint on the demand curve, while the reaction function for the ad valorem tariff is a vertical line passing through F. *Thus the best specific and ad valorem import tariffs in this situation are both positive.*

Finally, using a straight line demand curve and a supply curve which is flat up to some point where it becomes vertical, it is possible to show that monopolization by the seller may push the appropriate ad valorem or specific tariff up or down. Thus, the effect of monopolization on the appropriate ad valorem or specific tariff is uncertain, which establishes the part of Proposition 6 that refers to a demander's tariff.

4. Duopoly

Now let's explore the case of a duopolistic supplier.

and the bottom of it to be given by D. Thus given that 2's indifference curves are homothetic, its reaction curve for specific tariffs, R'_s, is FGI where FG is OF extended. This leaves the horizontal distance between R'_s and D for 1, which is shown as R_s in the rhp, the locus of attainable points for 1.

Ad valorem tariffs cause the effective ED to be given by ED as it is pivoted clockwise through C. In this case, the tangencies with indifference curves trace out FI, so 2's reaction curve is $R'_a \equiv$ FI, or R_a in the rhp.

When 1 imposes a prohibitive export quota, the effective ED becomes D. As the quota is relaxed, the top part of the effective ED shifts southwesterly in a parallel fashion, while the bottom part, where the quota is not binding is ED. For some quota, MT, the quota-distorted ED is tangent at A to the indifference curve passing through F and is given by MAUFC. For greater quotas, 2 will produce at F and for lesser quotas it will produce somewhere on AI. Thus the foreign reaction curve is $R'_q \equiv$ AI in the lhp where AI is OA extended, which means that 1 faces a reaction curve given by $R_q \equiv$ AI in the rhp.

In each case 1's best level of any type of restriction is given by the point where the curve marginal to R_L, R_s, R_a or R_q intersects S_1. By examining the configuration of these curves, it is clear that from country 1's standpoint, the best quota $\succ$ the best ad valorem tariff $\succ$ the best specific tariff $\succ$ free trade $\succ$ any binding price floor.

4.2 Duopoly when the foreign duopolist's marginal cost is positively sloped

The analysis for a positively sloping foreign duopolist's marginal cost, S_2, is similar, but not as simple, so we dispense with the formal analysis and simply state the intuitively plausible conclusion which emerges from it and the analogous analysis of duopsony as propositions 3 and 4, with the explicit analysis available upon request.

5. The best tariff for a buyer or seller in bilateral monopoly may be negative.

Now return to the example considered in the last paragraph of section 2.3 in which the home country is the seller, but instead of assuming the foreign country is benevolent as before, let us assume that it is malevolent, so that its secondary objective is to minimize its trading partner's welfare. In that case, the foreigner will trade at H in Figure 1 when the home economy is a free trader. Since the indifference curves are rectangular hyperbolae about Z, at each quantity, W, the slope of any indifference curve below I*, the one passing through F, must be greater than I*. Thus a specific subsidy which shifts downward the supply curve uniformly will cause foreign welfare to be maximized when B units are purchased. Thus producer's surplus with a small specific export subsidy may exceed that with any non-negative specific tariff. Similar proofs can be constructed for ad valorem export tariffs, and for both ad valorem and specific import tariffs for the buyer in bilateral monopoly. These yield Proposition 7.

6. Perspective

Our major conclusions are listed in the introduction. Let us just say that this analysis is not without relevance for the problems of how best to cope with a monopoly of oil supply for an oligopsonist like the U.S.[8] or for developing nations wishing to take advantage of monopoly or oligopoly power in jute or coffee. The author admits to a feeling of shame for writing about anti-competitive policies of which he disapproves, and to cleanse his conscience recommends a reform of GATT along the lines outlined in Tower (1983) to discourage the use of illiberal trade policies to exploit market power in the first place.

Appendix : The best ad valorem export tariff for a seller in bilateral monopoly

The demand curve is given by

$$p_d = D(W),\ D'<0 \qquad (1)$$

where p_d is the internal price in the consuming country and W is widget consumption, so the elasticity of demand can be written as

$$\eta = \frac{-dW/dp_d}{W/p_d} = \frac{-D}{WD'} \qquad (2)$$

(where η is defined to be non / negative) and the curvature of the demand curve can be written as

$$\phi = \frac{d(dp_d/dW)/dW}{(dp_d/dW)/W} = \frac{dD'/dW}{D'/W} = \frac{WD''}{D'} \ . \qquad (3)$$

Similarly, the supply curve is given by

$$p_s = S(W),\ S'>0 \qquad (4)$$

where p_s is the internal price in the supplying country, so the elasticity of supply can be written as

$$\sigma = \frac{dW/dp_s}{W/p_s} = \frac{1/S'}{W/S} = \frac{S}{WS'} \qquad (5)$$

and the curvature of the supply curve can be written as

$$\theta = \frac{d(dp_s/dW)/dW}{(dp_s/dW)/W} = \frac{dS'/dW}{S'/W} = \frac{WS''}{S'} \ . \qquad (6)$$

Note that both ϕ and θ are indeterminate in sign, and equal zero when demand and supply are linear.

An ad valorem export tariff at a rate a of the domestic price shifts the supply curve upward by a fraction a so the supply curve when distorted by the ad valorem tariff becomes

$$p_w = (1+a)S(W). \qquad (7)$$

where p_w stands for world price.

The marginal expenditure curve perceived by the foreign monopsonist is given by multiplying (7) by W and differentiating to yield

$$ME_a = (1+a)\,[S+WS'].\qquad(8)$$

Since the monopsonist will equate D to ME_a, we have

$$D = (1+a)[S+WS'] \qquad (9)$$

which can be rewritten as

$$D/[S(1+a)] = 1+1/\sigma \qquad (10)$$

and differentiated to yield

$$dW/da = -W/\Delta \qquad (11)$$

where $\Delta = -W\{ D' - (1+a)[2S' + WS'']\}/(S+WS') = (1+a)[(1/\eta)+(2+\theta)]/(\sigma+1)$.

For the equilibrium to be a welfare maximum for the monopsonist, ME_a must intersect D from below which implies $\Delta>0$.

The change in producer's surplus that results from changes in the sales price and quantity sold due to adjustment in the tariff is

$$dU = Wdp_w + [p_w-p_s]dW. \qquad (12)$$

Subtracting (4) from (7) yields

$$p_w-p_s = aS. \qquad (13)$$

The differential of (7) is

$$dp_w = (1+a)S'dW+Sda. \qquad (14)$$

Thus, combining (12), (13) and (14) yields

$$dU = [W(1+a)S'+aS]\ (dW)+WS(da). \qquad (15)$$

Equations (15), (11) and (10) can then be combined to yield

$$dU/da = (1+a)\{-a/(1+a)+(1/\eta) + [\sigma(1+\theta)-1]/[\sigma(\sigma+1)]\}WS/\Delta. \qquad (16)$$

Evaluating this expression for $a=\theta=0$ yields proposition 10A.

Then, to find the best ad valorem tariff we set (16) equal to zero to yield the introduction's equation I.

Now let us discover whether the best ad valorem tariff in the presence of foreign monopsony is higher or lower than the standard optimum tariff which applies in the presence of competition abroad. To do this we evaluate (16) when the ad valorem tariff is at the optimum level $(1/[\eta-1])$, and assume that the elasticity of foreign demand is the same in both the equilibrium which obtains under foreign competition and also that which obtains when the foreigner exploits its monopoly power. That expression is

$$\frac{dU}{da} = \frac{WSn(\sigma[1+\theta]-1)}{\sigma[1+\sigma+\eta(2+\theta)]} \qquad (17)$$

which yields proposition 11A.

Footnotes

[1]This assumes that any import or export licenses are auctioned off. A price floor is established by a variable export levy which is raised whenever the foreign price is below target, while a price ceiling is established by a variable import levy which is raised whenever the domestic price of the foreign good is above target. Alternatively, the price floor is established by a state trading authority which prohibits private exports whenever the world market price falls to or below the price floor and buys at the lowest domestic price possible sufficient quantities to supply the foreign market at that price floor. The alternative mechanism for establishing the import price ceiling is analogous.

[2]However, as shown in Sweeney, Tower and Willett (1977) in another context, the equivalence of the various instruments for the first agent are restored when the second agent acts like a Stackelberg leader and the first one acts like a follower.

[3]Throughout the paper our supplies and demands can be interpreted as excess supplies and demands with no effect on the analysis. Even though we do use partial equilibrium analysis, our logic is consistent with a two sector general equilibrium model in which both countries' income elasticity of demand for the good in question is zero if there are no other externalities or elements of imperfect competition other than the one considered. Moreover, our analysis is also legitimate in the context of a multisectoral general equilibrium model with no other elements of imperfect competition or externality and no other trade barriers where both the demands and supplies of the good in question depend solely on its price relative to the prices of

other goods and all other goods are traded between many countries at fixed prices, while the good in question is traded only between the two countries considered.

We have also assumed that the only elements of imperfect competition are each government's attempts to maximize its residents' welfare. One could perform similar analyses for other objectives like maximization of revenue or for complex blends of motives that characterize the literature on the scientific tariff.

[4]The general equilibrium two commodity analogue, shown graphically in Tower (1975, p. 268), is that country 1's best strategy is to select the tariff which causes 1's tariff distorted offer curve to pass through the point where the foreign reaction curve is tangent to 1's highest indifference curve, which implies that 1's best tariff will be given by $1/(\eta-1)$ where η is measured as the elasticity of 2's imports with respect to the terms of trade along 2's reaction curve instead of along 2's offer curve.

[5]By producer's surplus we mean the surplus accruing to the producing country. This includes rent to individual producers plus the revenue collected by the trading authority or tariff agency in the producing country. Thus the apostrophe is located before the s on purpose. If we recognize that some consumption occurs in the producing country, producer's surplus is rent to individual producers plus revenue to the producer's government, minus surplus lost by individual consumers due to the higher price that results from exporting. In each case it is a measure of welfare accruing from trade to the producing country. Consumer's surplus is defined analogously.

[6]R in Figures 1 and 2 is a straight line only if S passes through the origin.

[7]Sweeney (1974) has argued (p. 284) "that perhaps commodity stabilization schemes are actually attempts to do in the face of monopoly what an optimum tariff does under competitive conditions."

[8]On this see Willett (1976 and 1979).

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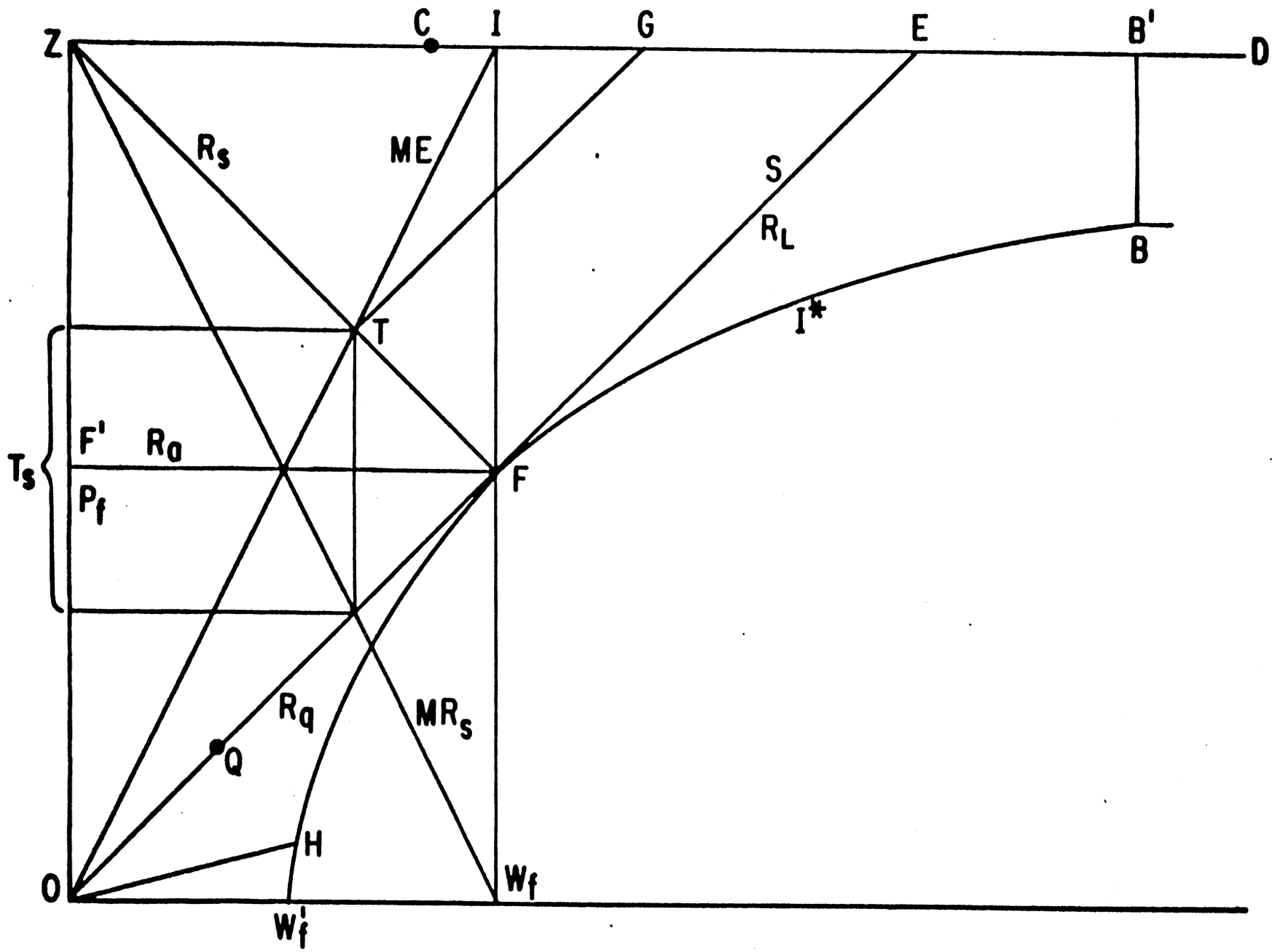

Fig. 1. The best trade restriction (perfectly elastic foreign demand).

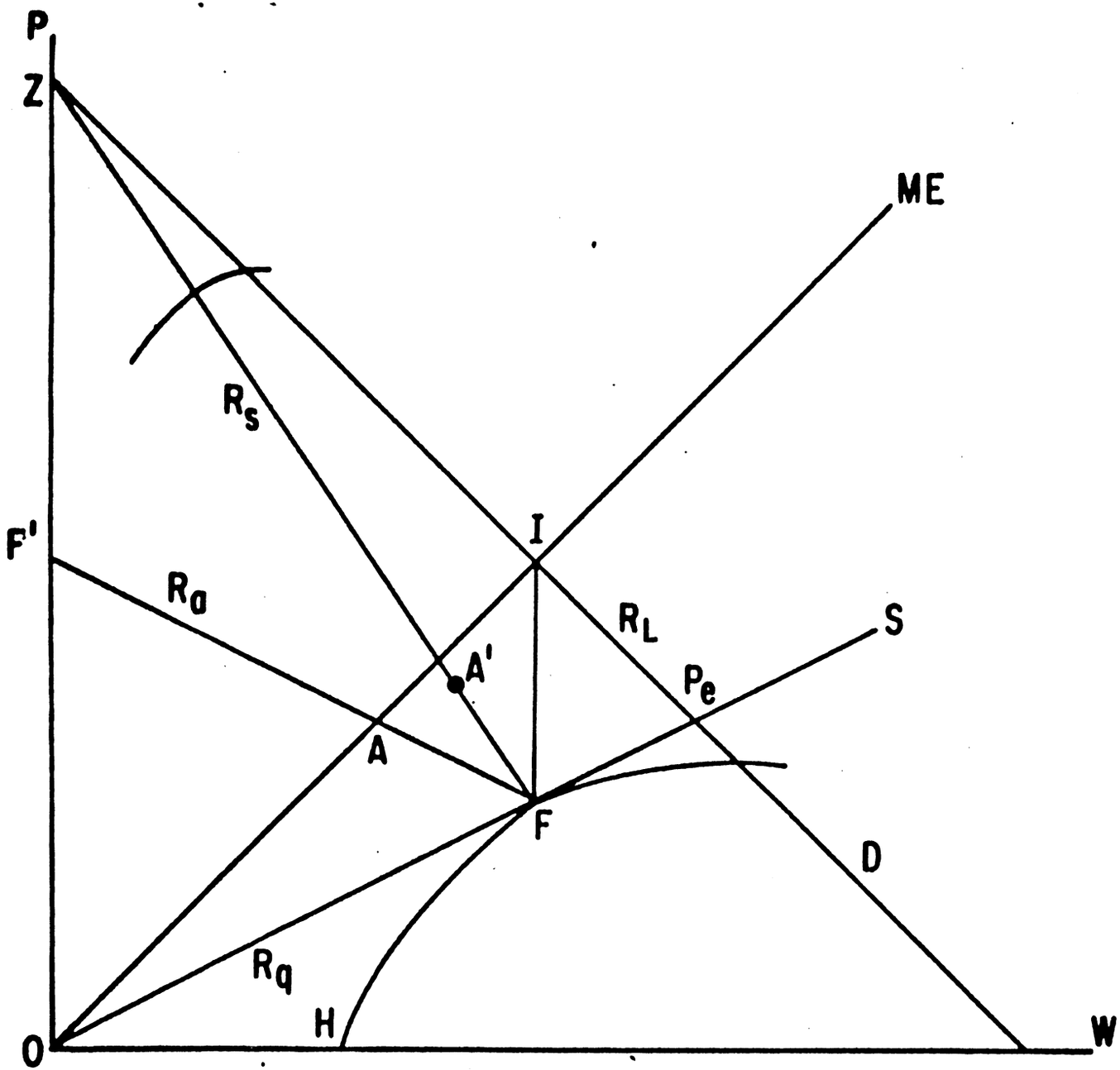

Fig. 2. The best trade restriction (imperfectly elastic foreign demand).

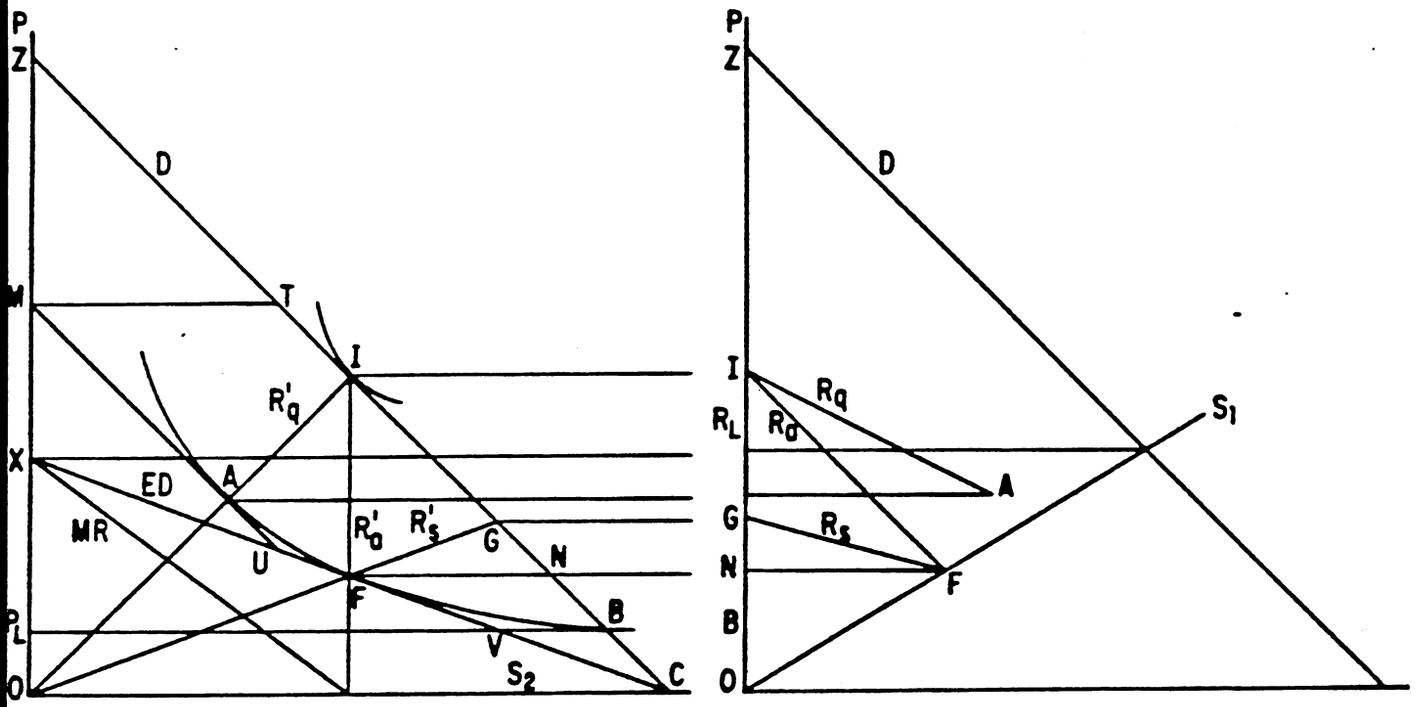

Fig. 3. Duopoly with zero costs.