The Optimum Tariff, Retaliation and Autarky

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Tibor Scitovsky (1942) and Harry G. Johnson (1953-4) have explored what would happen to a country which imposes the optimum tariff when its trading partner retaliates by imposing the optimum tariff in its turn. In their analyses "it is assumed that 'retaliation' takes the form of the imposition of an optimum tariff, on the assumption that the other country's tariff will remain unchanged," and the two countries take turns imposing the optimum tariff until a commercial-policy equilibrium or a recurrent tariff cycle is attained. Scitovsky (p. 99) concluded that equilibrium "need not but probably will be reached before international trade is completely eliminated . . ." Johnson amended this conclusion by noting: "That the adjustment process will never end in the elimination of trade is a logical consequence of the classical proposition that some trade is always better than no trade." However, this does not exclude the possibility that when both countries retaliate by imposing optimum tariffs, the system could approach autarky in the limit, or come within an "ϵ" of autarky for any "ϵ" given sufficient time. This paper demonstrates that even this is impossible if in autarky neither country would be completely specialized, and the community indifference curves are strictly convex.

Let us suppose that the tariffs of both countries are so high that trade has been cut to a very small proportion of consumption and production of both commodities in both countries.

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Since import demand is an excess demand for the commodity in question, we would expect the elasticity of the offer curve to approach infinity as trade approaches zero, and our expectation is borne out, for in appendix A it is shown that the elasticity of the tariff-distorted home demand for imports as a function of the terms of trade is

$$\mu = \frac{D\delta^* + S\sigma + Mm/(1+t)}{M[1 - mt/(1+t)]} \qquad (1)$$

where $\mu \equiv$ the elasticity of home demand for imports as a function of the terms of trade, defined to be positive for normal values;

$\delta^* \equiv$ the elasticity of home demand for the importable (along an indifference curve, i.e. holding real income constant) and $\delta^* \geqslant 0$;

$\sigma \equiv$ the elasticity of home supply of the import good and $\sigma \geqslant 0$;

$t \equiv$ the home tariff as a proportion of the world price of the import;

$m \equiv$ the home marginal propensity to spend on the importable out of income;

D, S and M are respectively home consumption of the importable, home production of the importable and the level of imports. Also, variables without primes refer to the home country and variables with primes refer to the foreign one.

Suppose it is the home country's turn to adjust her tariff and the world economy is resting in an equilibrium where $1 - m't'/(1+t') < 0$.

Then either the home country will benefit from a unilateral tariff reduction (until the inequality ceases to hold or the home tariff has fallen to zero), or else the two tariff-distorted offer curves must cross again somewhere further along both of them, where welfare for both countries is higher.[1] In the latter case, we assume that both countries take measures to move the economy to the mutually preferable equilibrium before either tariff is altered.

Thus, only in the normal case, where $1 - m't/(1 + t') > 0$, is tariff escalation a possibility. Restricting our attention to that case, we postulate that neither country would be specialized in the absence of trade. Clearly, after some point, as tariff escalation shrinks trade, M declines relative to D and S, and μ approaches infinity.[2] By invoking the same argument for the foreign country, it is clear that μ' also approaches infinity in the limit as trade approaches zero, where μ' is the elasticity of foreign demand for foreign imports as a function of the foreign terms of trade.

In appendix B, it is shown that home real income, W, depends on the home tariff according to

$$dW/dt = [-1 + t(\mu' - 1)]\,M(d\pi/dt)$$

where $1/\pi$ is the terms of trade of the home country. If the equilibrium is unstable, $d\pi/dt$ is positive, and a little geometry easily shows that unilateral tariff reduction will always improve the welfare of the tariff-cutting country. If the equilibrium is stable, an increase in a country's tariff will improve its terms of trade. In this case, $d\pi/dt$ is negative, and unilateral tariff reduction by the home country will increase home real income so long as $t > 1/(\mu' - 1)$. Therefore, if tariff escalation has already caused trade in both commodities to fall close to zero, both μ and μ' will be close to infinity and both countries will have an incentive to reduce tariffs unilaterally.[3] Thus, *the adjustment process will never end in the elimination of trade, even in a limiting sense, if neither country would be specialized in the absence of trade,*[4] *and the community indifference curves are strictly convex.*

[1] These conclusions can be demonstrated by constructing trade indifference curves and tariff-distorted offer curves. It is only necessary to remember the following: First, Kemp (1968) has shown that the condition for the foreign terms of trade to worsen as we move out from the origin along the foreign offer curve is $1 - m't/(1 + t') < 0$. Second, a country's welfare must be an increasing function of the distance along any of its offer curves (whether distorted by a tariff or not). Third, a country's welfare depends positively on its imports and negatively on its exports. Fourth, as Johnson (1953–4, p. 34) has written, "The reciprocal demand curve traced out by a higher tariff will always lie inside the curve traced out by a lower tariff rate. . ." Fifth, as Kemp and Tower (1975) have shown, at the last intersection of an offer curve with a given terms of trade line, the country's terms of trade must improve as we move out along its offer curve.

[2] This must be so, for as autarky is approached the denominator approaches zero. Even if the indifference curve which just touches but does not cross the production possibilities frontier has a kink at the point of contact between the two curves, in the neighborhood of that point at any equilibrium where there is some trade going on the indifference curve must be smooth and δ^* must exceed 0. Note that the assumption of strict convexity of indifference curves and nonspecialization in autarky implies that autarky is achieved before $t \longrightarrow \infty$.

[3] As Johnson (1967, p. 58) (among others) notes, $1/\mu' - 1)$ defines the optimum tariff.

[4] If we assume that the foreign economy is completely specialized in production of its exportable, then with a Cobb-Douglas utility function, μ' would be equal to unity for all positive relative prices and foreign tariff rates. This means that the foreign offer curve is a line which is parallel to the axis which represents the foreign import good. If this is the case, home real income will be an increasing function of the home tariff, no matter how high the home tariff is, and the optimum home strategy would be to let the home tariff approach infinity. This would cause home exports to approach zero without any change in home imports. Thus, if we admit the possibility of specialization, imposition of the optimum tariff by one country even in the absence of retaliation could drive trade in one commodity arbitrarily close to zero. If both countries have Cobb-Douglas utility functions and each is specialized in production of a different good, trade in both commodities will approach zero in the presence of retaliation. Thus, the assumption of non-specialization is integral to the conclusion of the paper.

Appendix A: Derivation of the Elasticity of the Tariff-Ridden Offer Curve

We assume that both countries produce and consume two goods. Using the notation of the text, we consider the home country. A tariff drives a wedge between the internal relative price of the import (p) and the external one (π) such that

$$p = (1 + t)\pi \qquad \text{(A1)}$$

where both prices are measured in units of the export per unit of the import.

The tariff revenue, R, (measured in units of the exportable) is given by $R = t\pi M$. Thus, with the tariff constant

$$dR = td\,[\pi M] \qquad \text{(A2)}$$

and

$$dp = (1 + t)d\pi. \qquad \text{(A3)}$$

Imports make up the difference between domestic consumption and production of the importable, so

$$M = D - S. \qquad \text{(A4)}$$

Movements along the transformation schedule are defined by

$$dS/S = \sigma\, dp/p. \qquad \text{(A5)}$$

Disposable income (measured in units of the exportable) is defined by $Y = Sp + B + R$, where B is home production of the exportable. Differentiating this relationship, while remembering that p is the slope of the production frontier so that $p = -dB/dS$, yields

$$dY = S\, dp + dR. \qquad \text{(A6)}$$

The demand schedule for the importable is given by

$$dD/D = -\delta\, dp/p + [m/(Dp)]\, dY \qquad \text{(A7)}$$

where $\delta \equiv$ the elasticity of home demand for the importable (holding constant income measured in units of the exportable), and $\delta > 0$ for normal values. By definition:

$$\mu = -[dM/M]\,/\,[d\pi/\pi]. \qquad \text{(A8)}$$

Substituting (A2) into (A6) to eliminate dR, and then substituting the result into (A7) to eliminate dY, yields an equation which (using (A1) and (A3) to eliminate p and dp and using (A8) to eliminate dM) can be rewritten as

$$dD/D = \{-\delta + m\,[tM - tM\mu + S(1 + t)]\,/\,[D(1 + t)]\}\, d\pi/\pi. \qquad \text{(A9)}$$

We substitute the derivative of (A4) into (A8) to acquire

$$\mu = -[(dD - dS)/M]\,/\,[d\pi/\pi]. \qquad \text{(A10)}$$

Combining (A5) with (A1) and (A3) yields

$$dS/S = \sigma\, d\pi/\pi \qquad \text{(A11)}$$

Using the Slutsky decomposition to rewrite δ as $\delta^* + m$, and substituting (A9) and (A11) into (A10) to eliminate dD and dS, yields, with the aid of (A4):

$$\mu M\{1 - mt/(1 + t)\} = D\delta^* + S\sigma + (M + S)m - m\,[tM + S(1 + t)]\,/(1 + t) \qquad \text{(A12)}$$

which simplifies to equation (1) of the text.

Appendix B: The Welfare Impact of a Tariff Change

Defining dW as the change in home real income measured in units of the exportable, and X as the level of home exports, we can write

$$dW = pdM - dX. \qquad \text{(B1)}$$

Since payments balance is continually maintained

$$X = \pi M. \qquad \text{(B2)}$$

Substituting the derivative of (B2) into (B1) to eliminate dM, and substituting from (A1) into the result to eliminate p yields

$$dW = tdX - (1+t)Md\pi. \qquad \text{(B3)}$$

By definition:

$$\mu' = [dX/X]/[d\pi/\pi] \qquad \text{(B4)}$$

which we substitute into (B3) to eliminate dX.

Substituting from (B2) to eliminate X and dividing the result by dt yields equation (2) of the text.

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