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IN THE THEORY OF INTERNATIONAL TRADE

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Abstract

The literature on international trade theory contains a series of paradoxes in cases of tariffs, growth, and transfers. This paper discusses the key role of income (as opposed to substitution) effects in supporting such paradoxes and suggests how the new welfare paradoxes in the three-agent transfer problem are related to the Metzler and Lerner tariff paradoxes, on the one hand, and that of immiserizing growth, on the other. The concluding section of the paper describes how far an optimal tariff policy can succeed in dispelling these paradoxes.

Income Effects and Paradoxes in the Theory of International Trade

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Every field in economics has its paradoxes, phenomena which initially are thought to confound economic sense but ultimately come to be better understood. The field of international trade can claim its fair share: the examples of the Metzler paradox wherein a tariff fails to provide protection, or that of immiserizing growth wherein a country suffers a loss in welfare despite an improvement in production possibilities come easily to mind. More recently a re-examination of the transfer problem in the context of many-country trade or of tax distortions has revealed possibilities for donor countries to gain or transfer recipients to lose--results which would be considered so paradoxical in standard treatments as to be ruled out by stability arguments.

Behind each of the examples just cited lies a rational explanation in which income effects prove crucial in supporting a paradoxical outcome. In some situations the potential for paradox rests on the possibility of income redistribution (nationally or internationally) when tastes differ among the various trading participants; paradox becomes impossible if tastes at the margin are identical. In other instances income redistribution could play a role, but paradoxical outcomes may occur even if all traders possess the same taste patterns. All cases share the property that paradoxes can arise only if the terms of trade are sufficiently disturbed; substitution effects, high values of which serve to dampen the required adjustment of prices to a market disturbance, thus work to prevent paradoxical outcomes.¹

In the first section of this paper I focus on those issues for which income effects associated with income redistribution are crucial, especially the analysis of tariffs and transfers in markets that initially are free of taxes or other distortions. In the second section I analyze an issue for which income redistribution is no longer the central ingredient: the welfare consequences of growth. A reinterpretation of the growth case is provided which serves to reveal the fundamental connection between a wide variety of standard two-country results in the theory of international trade and the possibility of paradoxes in the three-country transfer problem. In the final section I analyze briefly the frequently-encountered argument that some instances of (paradoxical) welfare loss can be avoided by optimal tariff policy.

1. Tariffs and Transfers with Initial Free Trade

Some disturbances to a trading equilibrium cause incomes to change for particular groups or countries but nonetheless neither create nor destroy real income for the world as a whole. The two standard cases that fall into this category involve either a small tariff from a position of initial free trade or an intra-national or international transfer of purchasing power.

Suppose there exists an initial, undistorted free trade equilibrium with many countries engaged in producing, consuming, and trading two commodities, A and B. Any change in A's relative price encourages substitution effects both in consumption and production and, as well, redistributes real income away from those groups who are net importers of the commodity whose price has risen towards those groups who are net exporters. Since both these effects play a central role in the succeeding discussion, it proves useful at the outset to

state them explicitly in elasticity form. Concentrating on commodity $\underline{A}$, the expression for $\omega_{\underline{A}}$ in (1) shows the increase in excess world demand for $\underline{A}$ (written as a percentage of initial total world demand (or supply) for $\underline{A}$) that would be induced by a one percent fall in $\underline{A}$'s relative price:

$$(1) \quad \omega_{\underline{A}} = S + \gamma$$

The expression, S , sweeps together all the (non-negative) substitution terms for each country in consumption ($\bar{\omega}_{\underline{A}}^i$) and production ($e_{\underline{A}}^i$) and, indeed, is the sum of a weighted average of each type. Thus:

$$(2) \quad S \equiv \sum_i \lambda_{\underline{A}}^i \bar{\omega}_{\underline{A}}^i + \sum_i \rho_{\underline{A}}^i e_{\underline{A}}^i,$$

with the $\lambda_{\underline{A}}^i$ indicating country i 's share in world consumption of $\underline{A}$ and $\rho_{\underline{A}}^i$ its share in world production. The term, γ , defined in (3), represents the net income effect of the price change on world demand:

$$(3) \quad \gamma \equiv \sum_i \beta_{\underline{A}}^i m_{\underline{A}}^i$$

Each $\beta_{\underline{A}}^i$ indicates the fraction of total world consumption (or production) of $\underline{A}$ that is represented by i 's net imports of $\underline{A}$. Thus $\beta_{\underline{A}}^i$ equals $(\lambda_{\underline{A}}^i - \rho_{\underline{A}}^i)$ and the sum, $\sum_i \beta_{\underline{A}}^i$, equals zero. The $m_{\underline{A}}^i$ refer to each country's marginal propensity to consume $\underline{A}$.²

The substitution term, S , must be non-negative, but is there any presumption as to the sign of the net income term, γ ? In a discussion of the transfer problem in a two-country setting (Jones, 1970), I argued in favor of a presumption that γ is positive, that is, that the marginal propensity to consume $\underline{A}$ on the part of the importer of $\underline{A}$ exceeds that on the part of the exporter. This presumption rests on the observation that a nation's trade

pattern is an outcome of two features assumed to be independent: its production pattern and its tastes. In the absence of any knowledge as to production, the trade pattern reveals information as to likely asymmetries in tastes. (A country with tastes biased towards commodity A is more liable to import A than to export A). Required as well is a presumed positive relationship between average and marginal propensities to consume. (If tastes are homothetic these are, of course, equal). Such a presumption can be labelled "anti-orthodox" because it leads, in the two-country transfer problem, to the conclusion that the terms of trade are apt to turn in favor of a country making a gift or reparations payment to another country. The opposite stance, that a transfer involves a "secondary burden" for the giver in the form of worsened terms of trade, was, in the earlier literature, considered "more likely" or, as Ohlin (1928) phrased it, "orthodox."

In the present setting in which many countries engage in trade the positivity of γ means that on "average" the marginal propensity to consume A on the part of an importing nation exceeds that for an exporter.³ I do not wish to re-argue the case for an anti-orthodox presumption here;⁴ instead in what follows I draw attention to some consequences of such a presumption.

The assumption that the world trading equilibrium is stable (in a Walrasian sense) implies that the elasticity ω_A in (1) is positive. Clearly the anti-orthodox presumption that the net income term, γ , is positive is sufficient to guarantee stability. The stabilizing role of substitution effects is obvious from (1), and in the models we discuss the term S always works against the existence of paradoxes. I turn now to the standard paradoxes found in tariff literature as well as to the transfer problem in the setting of many agents.

1. The Metzler Tariff Paradox

The paradox associated with Metzler's name (see Metzler, 1949)⁵ involves a country (say, h, for home country) levying a tariff on imports (assume h imports A) and by its action so depressing the world price of these imports that even after the addition of the tariff the domestic price of importables falls. To reveal the potential for such a paradox, it proves useful to investigate the state of the world market for A at the world price which represents a fall of exactly the amount of the tariff rate (which would leave the home country's domestic price of importables unchanged). Paradox occurs if and only if there is excess world supply at this price. In the world market the price of A has fallen to all the world's consumers and producers of A except those in country h, stimulating world demand (and cutting world supply) via the substitution term, $S_{(i \neq h)}$. As well, the drop in the world price of A redistributes income towards net importers of A, leading to income effects on world demand as captured by γ in (3). Excess world supply of A is thus created at this price (leading in equilibrium to the Metzler tariff paradox) if and only if

$$(4) \quad S_{(i \neq h)} + \gamma < 0$$

Several remarks are immediately apparent:

(i) The Metzler tariff paradox is possible if income effects are orthodox and substitution terms (in the rest of the world) are small. (This condition is sometimes written in a way that combines the income effect of the rest of the world with the substitution term to require ε^* , the elasticity of the rest

of the world's offer curve, plus the home marginal propensity to import, m_A^h , to fall short of unity.)

(ii) The Metzler tariff paradox is ruled out if income effects are anti-orthodox, ($\chi > 0$). Thus the same presumption on income effects that leads to a secondary "blessing" to the giver in the two-country transfer problem and guarantees the stability of the market also suffices to establish the normal result that a tariff raises the domestic price of importables.

(iii) The Metzler tariff paradox is less likely to occur if home substitution terms are relatively small, since S then becomes almost as large as total $\underline{S}$, and stability requires $(S+\chi) > 0$. Home substitution terms can be small either because response to price changes at home is relatively inflexible (small $\bar{w}_A^h$ and e_A^h) or because the home country is relatively small in world markets (small λ_A^h and ρ_A^h). Thus the Metzler tariff paradox is limited to cases of protection in relatively large countries.

2. The Lerner Tariff Paradox

Most discussions of the effect of a tariff on a country's terms of trade state either that a country is too small to affect world prices or that the tariff serves to reduce demand for importables at the initial terms of trade and thus to force a lowering of the world price of imports. In a classic article, Lerner (1936) demonstrated how a tariff might (paradoxically) worsen a country's terms of trade.⁶ Suppose there are two, separate, spending groups at home, the private sector and the public sector. A (new) tariff levied on importables serves to transfer income (the tariff revenue) from the private to the public sector at the initial terms of trade. Home substitution terms,

S , conspire to reduce world demand for A (since the local price is higher by the amount of the tariff rate), but the redistribution of income intra-nationally (there is no redistribution internationally at initial world prices) may so counter this that excess demand for importables rises.

The Lerner effect depends both on a particular asymmetry in taste patterns (the public sector has a higher marginal propensity to import A than does the private sector) and on sufficiently weak substitution terms (at home). If there is any presumption that the public sector would tend to channel a higher fraction of extra spending on home produced exportables than would the private sector, the Lerner paradox is ruled out.

There are three separate spending groups identified in the Lerner problem (two groups at home and one in the rest of the world), and it thus serves as a convenient introduction to the transfer problem in a three-agent setting. After analyzing the transfer paradoxes in the next subsection, I return to the tariff case in order to see how far the analogy can be pursued.

3. Transfer Paradoxes with Three Agents

The terms "orthodox" and "anti-orthodox" have already been mentioned in the context of the transfer problem; they refer to the direction in which the terms of trade are pushed by a gift from one party (country) to another. The criterion for the direction of price changes stays the same whatever the number of participants (involving, as it does, only the marginal taste patterns of giver and receiver), but the same is not the case for another standard result in the classical two-country transfer literature: the secondary effect of terms-of-trade changes cannot outweigh the primary effects

of the transfer, implying that the giver must lose (or at least not gain) and the recipient gain.⁷

A sizeable literature on the transfer problem when there are three (or more) agents is currently accumulating. Some of the significant contributions include a general but insightful discussion in Johnson (1960), followed by an algebraic analysis within the same framework by Komiya and Shizuki (1967). More recently, a paper by Gale (1974) illustrates a case (with fixed coefficients in utility functions), in which giver and receiver both gain at the expense of a third party. The Gale model was subsequently discussed by Chichilnisky (1980) to focus on the case in which the recipient of a transfer suffers a loss. Brecher and Bhagwati (1981) include an analysis of the three-agent transfer problem in a paper devoted to the welfare consequences of the coexistence nationally of domestic and foreign productive factors, while Yano (1983) directly generalizes the results of the Gale paper. (The latter two papers are independent contributions.) More recently, Bhagwati, Brecher and Hatta (1983a) explore various decompositions of the kinds of formulae for real income changes found in Brecher and Bhagwati (1981) and Yano (1983).

The possibility for paradox in this literature can be revealed by following the procedure for the case with no substitutability outlined in Jones (1984). Consider the situation of the Giver, $\underline{G}$, who makes a gift to the Receiver, $\underline{R}$, in a trading world that contains third parties. These latter are lumped together for convenience into a single uninvolved country, $\underline{U}$. The Giver suffers a loss in real income if the terms of trade do not change. Let the initial relative price (of $\underline{A}$) equal p_0 and let p^G denote the price of $\underline{A}$ which, if attained in the market, would represent a terms-of-trade improvement

for the Giver that would exactly balance the primary transfer loss and leave $\underline{G}$'s real income, y_G , unaltered. The crucial question becomes: what is the state of the world market for $\underline{A}$ at price p^G ? For, if the new equilibrium terms of trade settle even further from p_0 than is p^G (but, of course, in the same direction) the Giver would experience a rise in welfare--a paradoxical outcome. This paradox would emerge in either of two cases: the Giver exports $\underline{A}$ and there is excess demand at p^G (which exceeds p_0) or, if p^G is lower than p_0 (indicating that the Giver imports $\underline{A}$), there is excess market supply of $\underline{A}$. Let δ_A^G indicate excess world demand for $\underline{A}$ at price p^G , as a percentage of total world consumption or production. Thus the condition for paradox is:

$$(5) \quad \Delta y_G > 0 \quad \text{iff} \quad (p^G - p_0) \cdot \delta_A^G > 0$$

Note the required correlation between price and excess demand in order to make a paradox possible: a price rise (fall) must be associated with a positive (negative) value of excess demand. (Substitution terms by themselves produce the opposite correlation.)

The relative excess demand at price p^G depends, in turn, on substitution and income effects. For small transfers (so that p^G is close to p_0) the substitution term (the change in excess demand as a percent of initial world demand) is $-\underline{S}$ times the relative price change, $(p^G - p_0)/p_0$, and is therefore negative if p^G lies above p_0 . The income term only reflects income redistribution, since the transfer neither creates nor destroys world real income. At price p^G the Giver's real income remains constant, by definition, so the redistribution only involves the Receiver and the Uninvolved party. Therefore the excess demand for $\underline{A}$ created at p^G through this income-redistribution effect is

$$(m_A^U - m_A^R) \frac{\Delta y^u}{p_0} .$$

The term Δy^u is the change in the uninvolved party's real income at price p^G in units of $\underline{B}$; the division by p_0 converts this to $\underline{A}$ -units. Expressing this change in excess demand relative to total initial world demand, D_A , and combining with the substitution term yields:

$$(6) \quad \delta_A^G = -S \frac{(p^G - p_0)}{p_0} + (m_A^U - m_A^R) \frac{\Delta y^u}{p_0 D_A}$$

The change in the third party's real income at price p^G , Δy^u , has been selected rather than the change in the Receiver's real income in (6) since the former depends only upon the extent of the change in the terms of trade and $\underline{U}$'s trading stance and not directly upon the value of the transfer. Explicitly, letting M_A^U denote the net imports of $\underline{A}$ by the uninvolved party (negative if $\underline{U}$ exports $\underline{A}$),

$$(7) \quad \Delta y^u = -(p^G - p_0) M_A^U .$$

Now substitute (7) and (6) into criterion (5) to obtain:

$$(8) \quad \Delta y_G > 0 \quad \text{iff} \quad S + \beta_A^U (m_A^U - m_A^R) < 0 .$$

This expression corresponds to the formulae in Brecher and Bhagwati, and in Yano.

The criterion, (8), for a paradoxical outcome for the Giver can be supplemented by criterion (9) for a paradoxical outcome in which the Receiver's real income, y_R , is depressed by a transfer:

$$(9) \quad \Delta y_R < 0 \quad \text{iff} \quad S + \beta_A^U (m_A^U - m_A^G) < 0 .$$

The proof follows similar lines, the roles of Giver and Receiver merely being transposed.

These criteria for paradox in the transfer literature once again pit substitution effects (always working to encourage "normal" outcomes) against possible income effects. Note that the income effect, in turn, depends on an asymmetry in taste patterns between the other party directly involved in the transfer (the Receiver in (8)) and the Uninvolved third party. If taste patterns are similar with respect to marginal income changes, or if the third party's net volume of trade is insignificant, paradox is ruled out.⁸ A paradox necessitates that trade patterns must be orthodox in tone for the Uninvolved party since either (8) or (9) reveals that for a paradox $\underline{U}$ must have a taste preference for $\underline{A}$ (relative either to $\underline{R}$ or $\underline{G}$) if $\underline{U}$ is an exporter of $\underline{A}$.

Although the taste and trade pattern for the giver do not explicitly get revealed in criterion (8), this can be rewritten by adding the term $\beta_A^G(m_A^G - m_A^R)$ to both sides and noting that the aggregate income term χ , defined in (3), equals $\beta_A^G(m_A^G - m_A^R)$ plus $\beta_A^U(m_A^U - m_A^R)$. That is, (8) for the Giver corresponds to (8'):

$$(8') \quad \Delta y_G > 0 \quad \text{iff} \quad \beta_A^G(m_A^G - m_A^R) > S + \chi (> 0).$$

A paradox for the Giver requires that the terms of trade turn in its favor, i.e., that it has an anti-orthodox taste bias for the commodity it imports (a positive $\beta_A^G(m_A^G - m_A^R)$), although a comparable anti-orthodox taste bias for the Uninvolved country (i.e., positive $\beta_A^U(m_A^U - m_A^R)$), insures that the terms of trade do not turn so much in the Giver's favor as to lead to paradox.⁹

4. Similarities Between Tariff and Transfer Paradoxes

My previous brief remarks on the Lerner tariff paradox suggested the key importance of having three distinct agents. If a country levies a tariff and the public and private sectors of the economy have different spending patterns (and the tariff proceeds are not redistributed), does the possibility that the domestic price of protected imports falls (the Metzler paradox) or the terms of trade worsen (the Lerner paradox) bear a structural resemblance to the paradoxes possible in the three-agent transfer problem? Clearly there is a crucial role for income effects in both cases--indeed for a pure income redistributive effect since neither transfers nor small tariffs (from an initial free trade position) create or destroy world income. Similarly, the role of substitution effects in militating against paradox is shared in both instances. The similarity is even closer than these remarks suggest, although the effect of a tariff in creating a wedge between home and foreign prices prevents the analogy from being exact.

The "transfer" in the tariff case is that between private and public sectors in the tariff-levying country, represented by the tariff revenue. Of course the amount of this transfer is endogenous. Tariff literature focuses on the behavior of prices--does home import price rise and foreign price fall (the normal case)? But this readily translates itself into the transfer literature's concern with welfare. Identify the private sector in the tariff-levying country as the Giver, $\underline{G}$, the public sector as the Receiver, $\underline{R}$, and the foreign country as Uninvolved ($\underline{U}$) in the direct transfer. In this fashion the Metzler paradox becomes associated with the transfer paradox for the Giver; a tariff that leads to a lowering of the domestic price of imports represents a

gain to consumers in the private sector net of the transfer (tariff revenue) payment. Similarly the Lerner tariff paradox, wherein the home country's terms of trade deteriorate with a tariff, represents a gain for the Uninvolved party to the transfer, the foreign country. There is no possibility of paradox for public sector Receiver since initial free trade implies zero initial tariff revenue whereas post-tariff revenues are positive.

Focusing upon the Giver in the tariff analogy, critical price p^G is the original domestic price of $\underline{A}$. At this price excess world demand for $\underline{A}$ consists of a substitution term as the foreign country ($\underline{U}$) faces a lower price (by the amount of the tariff) as well as an income term which captures the redistribution of real income from foreign $\underline{U}$ to the public sector at home ($\underline{R}$). Having assumed the home country imports $\underline{A}$ (the commodity upon which the tariff has been levied), β_A^U is negative. At the original domestic price of $\underline{A}$ a paradoxical excess world supply of $\underline{A}$ exists, leading to a Metzler tariff paradox and thus a gain to the private sector at home (G), if the inequality in (10) is satisfied:

$$(10) \quad \Delta y_G > 0 \quad \text{iff} \quad \underset{(i=U)}{S} + \beta_A^U (m_A^U - m_A^R) < 0$$

The similarity with the transfer paradox criterion for the Giver in (8) is striking, but not complete.¹⁰ Substitution effects in both (8) and (10) deter the possibility of paradox, but in the Metzler tariff case, (10), the substitution terms only represent those in the foreign ($\underline{U}$) country. In this sense the Metzler tariff paradox might be deemed "more likely" than a welfare transfer paradox for a Giver.

The Lerner paradoxical possibility is analyzed in similar fashion. Key price p^U is the original terms of trade. A paradoxical worsening of the home country's terms of trade (or $\Delta y_u > 0$) would follow if excess world demand for A is created at this price. Substitution terms are again present, but now only in the home country, $S_{(i \neq U)}$, as p_A rises at home by the amount of the tariff rate at given world prices. The redistribution of income at original terms of trade is the transfer represented by the tariff revenue paid by the private sector (G). Alternatively, it is represented by G's deteriorated terms of trade (the rise in the domestic price). A paradoxical rise in the world's relative price of A follows if the inequality in (11) is satisfied:

$$(11) \quad \Delta y_u > 0 \quad \text{iff} \quad S_{(i \neq U)} + \beta_A^G (m_A^G - m_A^R) < 0.$$

Although home substitution effects militate against it, the Lerner paradox could follow if public sector (R) tastes are sufficiently biased towards the commodity imported at home.

The analogy between tariff and transfer cases is thus in evidence, although the tariff wedge divides up the substitution terms. I turn now to a classic case in which income effects represent more than a mere redistribution among trading parties. Notwithstanding this important difference, analogies can still be found with the paradoxes associated with the transfer problem.

II. Growth and Changes in World Income

Some disturbances to a free trade equilibrium cause net world income to rise or fall, so that even if all taste patterns are identical there remains a net income effect. Here I concentrate on the phenomenon of growth and the paradoxical possibility that growth may prove to be immiserizing.

In a closed economy growth of production possibilities is usually associated with improvements in welfare, but in an open economy home growth may lead to such a deterioration in the terms of trade that the welfare gains from growth are transferred to the rest of the world. This possibility was discussed in the last century by Edgeworth (1894), whose paper was noted by Bhagwati and Johnson (1960) and Mundell (1960). Prior to these 1960 papers Johnson (1953, 1955) analyzed the circumstances under which a growing country's real income could fall, and this analysis was pursued further in Bhagwati (1958). The phenomenon is by now familiar to all students of trade.

As stressed in these articles, the possibility that a country could be immiserized by growth depends both on sufficiently low elasticity in world demand and upon the appropriate skewness in the composition of growth; immiserization is most likely to occur when a country's growth is biased towards its export sector. These points can easily be brought out in a manner that highlights both the similarity and the difference between the growth case and the transfer case. The difference stressed here is that transfers (in untaxed equilibria) redistribute a given world income whereas growth expands real income for the world as a whole. The similarity lies in the means of analysis leading, in the growth case, to a criterion for paradoxical immiserization that parallels that for the receiver in the three-person transfer problem. Indeed a reinterpretation of the growth problem can be devised which converts it to an example of the three-agent transfer problem.

Let h denote the home country, and suppose all other countries are lumped together in a country labelled "U". Assume that growth takes place only at home and results, at initial prices (p_0 for the relative price of A), in

changed home production $(\Delta x_A^h, \Delta x_B^h)$. If prices were to remain constant, the quantity $\{p_0 \Delta x_A^h + \Delta x_B^h\}$ would represent the improvement in real income at home (measured in B-units). A change in the terms of trade induced by growth serves to redistribute welfare between $\underline{h}$ and $\underline{U}$, but the change in net consumption possibilities for the world, Δy_w , is still given by this term:

$$(12) \quad \Delta y_w = p_0 \Delta x_A^h + \Delta x_B^h$$

To capture the composition of home growth let n_A^h denote the fraction of Δy_w represented by increased production of $\underline{A}$ at home:

$$n_A^h \equiv \frac{p_0 \Delta x_A^h}{\Delta y_w}$$

With these concepts in hand, the analysis can proceed along the lines adopted for the transfer in equations (5)-(7). Thus let p^h denote the terms of trade (a deterioration) which, if it occurred in the market, would exactly balance the direct welfare benefit of growth at home and leave home real income unaltered. A paradoxical lowering of real income at home would ensue if, at this price, there exists positive excess supply of the home country's export good. That is,

$$(13) \quad \Delta y_h < 0 \quad \text{iff} \quad (p^h - p_0) \delta_A^h > 0,$$

where, as before, δ_A^h is excess world demand for $\underline{A}$ at price p^h .

Excess world demand, δ_A^h , consists of substitution effects (as in the transfer case), an income effect and a direct effect of growth on world supply at initial prices. The income effect no longer captures a pure redistribution between two groups other than the home country. Instead, at p^h all the increase in world income accrues to the (uninvolved) country $\underline{U}$, so that demand

for $\underline{A}$ increases by $m_A^U \cdot \frac{\Delta y^u}{p_0}$. However, the world supply schedule for $\underline{A}$ has shifted by amount $n_A^h \cdot \frac{\Delta y_w}{p_0}$, where Δy_w , shown by (12), equals Δy^u . Combining substitution effect, income effect, and supply effect, all expressed as a fraction of initial world demand for $\underline{A}$, yields:

$$(14) \quad \delta_A^h = -S \frac{(p^h - p_0)}{p_0} + (m_A^U - n_A^h) \cdot \frac{\Delta y^u}{p_0 D_A}$$

Finally, although the expression for Δy^u could be written as Δy_w in (12), it also equals the pure terms-of-trade effect on $\underline{U}$'s income:

$$(15) \quad \Delta y^u = -(p^h - p_0) M_A^U$$

Substitute (15) and (14) into (13) to yield (16) as the criterion for a paradoxical immiserization for growing country $\underline{h}$:

$$(16) \quad \Delta y_h < 0 \quad \text{iff} \quad S + \beta_A^U (m_A^U - n_A^h) < 0.$$

Familiar results emerge from this expression. First, the paradox of immiserization is ruled out if world substitution terms in consumption and production are sufficiently large. Secondly, if the home country exports $\underline{A}$ and all its growth is concentrated in $\underline{A}$ production so that n_A^h is unity, immiserization appears as a possibility if $\underline{S}$ is sufficiently small and in the foreign country ($\underline{U}$) exportables ($\underline{B}$) are not inferior. Finally, (16) reveals the crucial comparison between the fraction of home growth expressed in extra A-production and the fraction of extra income abroad that would be channeled into A-consumption. This mixture of home production change and foreign income propensity is appropriate since at border-line terms of trade p^h all the world's increase in real income is captured by foreigners.¹¹

This scenario of growth in one country embedded in a two-country world can be interpreted as an example of the pure transfer problem for three agents. The interpretation rests upon a trick borrowed from the theory of games. Relabel the growing home country as R (for Receiver), and let the value of its growth at initial prices, Δy_w , be considered a gift (a transfer) from Nature (the Giver). At price ratio p^R the value of the gift accrues to the uninvolved rest of the world, whose demand for $\underline{A}$ increases by $m_A^U \cdot \frac{\Delta y_w}{p}$. The fictitious Giver, meanwhile, is assumed to cut back its spending on $\underline{A}$ by the fraction m_A^G times $\Delta y_w/p$. Identify m_A^G with n_A^h . That is, the original composition of the expansion in supply at home (the Receiver) is now viewed as an expression of the taste pattern of Nature, which is divesting itself of real income to the same extent as the rest of the world expands spending. Criterion (16) thus re-interpreted becomes the same as criterion (9) for the paradoxical outcome for the Receiver in the three-agent transfer case.

This procedure highlights the structural similarity between the growth example and the transfer case. But it does more than this. It establishes the analysis of the three-agent transfer problem as more widely applicable than the original phrasing of the problem suggests. (Section I.4 already argues this case for tariff paradoxes.) Any disturbance to a two-country trading equilibrium which creates or destroys net income for the world as a whole by changing supplies of commodities can be viewed as a problem in pure redistribution of income in which a fictitious third party's (Nature's) tastes reflect the character of the initial supply disturbance. In my opinion this interpretation provides the fundamental link between these two classes of problems.

Of course Nature's tastes, as described above, may be much more skewed than tastes are usually thought to be. Growth in factor supplies (or technical progress in one sector) conveys familiar magnified effects on output, so that no a priori bounds can be placed on n_A^h (i.e., m_A^G). This has familiar consequences, one of which can be stressed by considering the criterion in (16). Whatever the composition of growth, if substitution effects are sufficiently great, the home country must gain. (In the transfer problem if no good is inferior, requiring $\underline{S}$ to be greater than unity is more than sufficient to rule out paradox.) But it is also the case that regardless of how flexible are substitution responses to price, some types of (highly skewed) growth can lower a country's real income. At the limit consider a country whose transformation schedule shifts southeastwards (or northwestwards), remaining tangent to its original trading or budget line, but requiring a higher concentration of resources in its export sector. The country's terms of trade deteriorate and welfare falls. A slight outward shift of the transformation schedule (preserving the same skewed pattern of output changes) would not be sufficient to compensate for this loss.

The growth case provides an example in which aggregate world income changes at initial prices because world supplies of commodities are altered. But the existence of price distortions in the initial equilibrium can also support changes in world income even if no shifts in world supplies of any commodity take place. An example of this phenomenon in a two-country setting (see Brecher and Bhagwati (1982)) involves the home country, with a tariff on imports in place, being the recipient of a transfer. Net world income changes if the volume of imports into the protected home market is affected by the transfer. Substitution effects once again militate against a paradox: the

home Recipient could lose only if the world price of its imports (and therefore also the home price) rises sufficiently, and substitution effects encourage excess supply of importables at such a price. Since world income shrinks as home imports fall, home importables must be inferior in the foreign Giver's taste pattern to encourage sufficiently strong income effects to make net world excess demand positive at such a price.¹² Paradox may occur, but the conditions are extremely strict.

III. Paradoxes and the Optimal Tariff

It is often argued that the kind of paradox discussed above, in which growth (or a transfer receipt) leads to a worsening of national real income because of adverse movements in the terms of trade, can be forestalled if the country in question follows the appropriate (optimal) tax or tariff policy.¹³ The argument typically assumes that the net foreign demand schedule (the foreign offer curve) is not shifted by the initial disturbance, but this requirement can in some cases be waived.

I restrict my comments initially to a two-country setting. Equation (17) shows real income for the home country as dependent upon the foreign relative price of commodity $\underline{A}$, p_A^* , assumed to be imported by the home country, as well as the quantity of foreign exports of $\underline{A}$, X_A^* , and the shift parameter, α :

$$(17) \quad y = y\{p_A^*(t, \alpha), X_A^*[p_A^*(t, \alpha), \alpha], \alpha\}.$$

The expression $\partial y / \partial p_A^*$ captures the terms-of-trade effect on home welfare (and equals $-X_A^*$). The derivative $\partial y / \partial X_A^*$ vanishes if there exists free trade, but if a tariff has been levied by the home country it equals the value of the tariff wedge (tp_A^*). A change in the parameter α may cause the foreign offer

curve to shift (outwards if $\partial X_A^*/\partial \alpha$ is positive), and, as well, may cause a welfare change at home even with given terms and volume of trade (as when growth takes place). Finally, the terms of trade are shown to be dependent upon the home tariff rate and the shift parameter, α ; the nature of the dependence on the tariff rate is often illustrated by a shift of the home offer curve to move the equilibrium point (and price ratio) along the foreign offer curve.

Differentiate (17) totally to obtain:

$$(18) \quad dy = \left\{ \frac{\partial y}{\partial p_A^*} + \frac{\partial y}{\partial X_A^*} \frac{\partial X_A^*}{\partial p_A^*} \right\} \frac{\partial p_A^*}{\partial t} dt + \left\{ \left[\frac{\partial y}{\partial p_A^*} + \frac{\partial y}{\partial X_A^*} \frac{\partial X_A^*}{\partial p_A^*} \right] \frac{\partial p_A^*}{\partial \alpha} + \left[\frac{\partial y}{\partial \alpha} + \frac{\partial y}{\partial X_A^*} \frac{\partial X_A^*}{\partial \alpha} \right] \right\} d\alpha$$

The first bracketed expression shows how a change in the terms of trade affects welfare at home directly, as well as through a change in the volume of trade. The tariff rate is assumed to be at the optimal level so that this expression is set equal to zero. This is not to say, of course, that the home country manages to freeze the world terms of trade and thus avoid secondary effects of price changes. Instead, it states that the tariff rate is set such that any further disturbance in the terms of trade (for given α) has a second-order effect on home welfare. Since the coefficient of $\partial p_A^*/\partial \alpha$ is the same as the first bracketed expression, it is set equal to zero by the optimal tariff policy and the effect of the α disturbance on real income is shown by:

$$(19) \quad \frac{dy}{d\alpha} = \frac{\partial y}{\partial \alpha} + \frac{\partial y}{\partial X_A^*} \frac{\partial X_A^*}{\partial \alpha}.$$

Several alternative disturbances are considered in turn:

1. Growth at Home

Suppose the home country's production possibilities schedule shifts out such that the change in outputs at constant prices is $\{d\bar{x}_A, d\bar{x}_B\}$, with income change (at given domestic prices) $d\alpha \equiv p_A d\bar{x}_A + d\bar{x}_B$. Then $\partial y / \partial \alpha$ is unity and, since the foreign offer curve does not shift, $\partial X_A^* / \partial \alpha$ is zero. That is, regardless of the composition of the shift in home outputs, real income at home increases hand-in-hand with the value of produced income at initial prices. Optimal tariff policy has banished the spectre of immiserizing growth.

2. Growth at Home and Abroad

If the foreign country's demand for imports should shift inwards, with no shift at home, an optimal tariff policy will not prevent a deterioration in home welfare. This is no paradox. But consider the case in which the change in α reflects a worldwide increase in the quantities of home exportable (B) produced at initial prices both at home and abroad. Let $d\alpha$ equal $d\bar{x}_B$ and $d\bar{x}_B^*$ equal $\mu d\alpha$. Once again $\partial y / \partial \alpha$ equals unity, but $\partial X_A^* / \partial \alpha$ no longer vanishes. Instead, this term reflects the effect of the increase in foreign incomes in diverting potential exports of A to its own market. That is,

$$\frac{\partial X_A^*}{\partial \alpha} = \mu \frac{\partial X_A^*}{\partial \bar{x}_B^*} = -\mu \frac{\partial D_A^*}{\partial \bar{x}_B^*} = -\mu \frac{m_A^*}{p_A^*}.$$

As usual, the term $\partial y / \partial X_A^*$ is the tariff wedge, tp_A^* . Assembling these terms leads to:

$$(20) \quad \frac{dy}{d\alpha} = 1 - \mu t m_A^*.$$

If the foreign country had not experienced growth ($\mu = 0$), the result would be as earlier described: the optimal tariff policy being pursued at home would lead to a welfare increase for home residents by an amount equal to the expansion in production possibilities. If the increase in home production of its exportables is matched to some extent by a comparable production expansion abroad, trade would be cut back and the home welfare gain diminished. Expression (20) shows how much foreign growth (in the home country's export item) can be tolerated before home real incomes fall despite the optimal tariff policy. Of some interest, perhaps, is the case in which μ is unity: if goods are normal and the optimal tariff rate less than unity, a matching (absolute) expansion worldwide in the production of home exportables leads to shared gains at home and abroad.

3. Transfers and Welfare

Perhaps not surprisingly, the welfare paradoxes associated with transfers in the three-agent setting can in certain circumstances be ruled out by appropriate taxation policy. Bhagwati, Brecher, and Hatta (1983) analyze the case in which the Giver and Receiver groups form a customs union and, by pursuing an optimal tariff policy, insure that such a transfer does not entail paradoxical welfare changes for either party in the union.¹⁴ Here I sketch a different example: the home country receives a transfer from abroad and follows an optimal tariff rule by itself.

Let $d\alpha$ represent dT , the transfer receipt in the home country, so that once again $\partial y / \partial \alpha$ equals unity. Let the rest of the world be made up of two different groups: the Giver, $\underline{G}$, and the Uninvolved party, $\underline{U}$. Before the transfer these two regions can be consolidated and a "foreign" offer curve

showing their total X_A^* constructed, with an optimal home tariff rate setting the first bracketed expression in (18) again equal to zero. $\partial y / \partial X_A^*$ is, as always, the tariff wedge, tp_A^* . Finally, $\partial X_A^* / \partial \alpha$ refers only to $\underline{G}$'s changed demand. If $\underline{A}$ is normal in consumption, $\partial X_A^* / \partial \alpha$, equal to m_A^G / p_A^* , is positive. That is,

$$(21) \quad \frac{dy}{d\alpha} = 1 + tm_A^G.$$

Not only does the home recipient keep the initial value of the gift, its pursuit of an optimal tariff policy allows further gains as it increases its imports of $\underline{A}$ that are subject to the duty.¹⁵

The effect of transfer on income shown by (21) is a special case of the result shown in previous expression (20) for growth throughout the world. A value of μ equal to -1 in (20) could reflect home growth and matching foreign contraction in real income at initial prices. Thus the close connection between the transfer problem and growth described earlier applies as well to the use of optimal tariff policy in warding off a welfare loss by the recipient of gifts, either from Nature's bounty or directly from the rest of the world.

IV. Concluding Remarks

Economists are familiar with the potentially troublesome role which income effects can play in destabilizing commodity markets, just as they are familiar with the stabilizing effect of substitution responses to price changes. This asymmetric stance of income and substitution effects is also seen to underlie some of the paradoxes in the literature on international trade. These issues were discussed in the first two sections of this paper. In the first section

income effects referred only to the redistribution of income involved when countries levy tariffs or engage in transfer payments. Such redistribution washes out in its effect on market demand if tastes at the margin (income propensities) are identical among trading parties; with only substitution terms left the Metzler and Lerner tariff paradoxes cannot occur, and in the transfer problem the giving party experiences a reduction in welfare and the recipient a gain. The terms of trade may change (in the tariff case), but in the absence of net income effects these price changes are kept within bounds sufficient to rule out these paradoxes. Much the same can be said even if tastes are dissimilar if what is known as "anti-orthodox" trading patterns are generally in evidence--with countries importing commodities for which marginal and average spending propensities are relatively high.

Some disturbances involve not only a redistribution of income, but also a net gain or loss in world welfare.. Examples of two such disturbances were discussed in the second part of the paper: economic growth in one or more countries and transfer payments in a world characterized by distortions such as tariffs. Growing open economies may lose more via a possible terms-of-trade deterioration than they gain directly by growth, but welfare paradoxes with transfer when tariffs exist in the initial situation require severe inferiority in consumption patterns. Any disturbance to a two-country world that creates a net gain or loss in world income (such as characterizes a vast array of literature in trade theory) can, by suitable re-interpretation, be translated into a disturbance that involves pure redistribution of income among the two countries and a fictitious third party, "Nature." This device establishes the basic link between such paradoxes as immiserizing growth in a two-country setting and the transfer paradox for the receiver in a three-agent

setting, and thus reveals the potential importance of the three-agent transfer literature.

Finally, the role of optimal commercial policy in staving off potential paradoxes was examined in the last section. The standard argument that optimal tariffs can forestall immiserizing growth or transfers when the rest-of-the-world's offer curve does not shift is extended to some cases in which both or all countries find their excess demand curves altered.

Footnotes

- *I wish to thank Isaias Coelho for helpful conversations and Makoto Yano for stimulating my interest in the transfer problem with many agents. Useful suggestions were also received at seminar presentations at the Institute for International Economic Studies in Stockholm and the London School of Economics. Research support was provided by the National Science Foundation Grants SES-7806159 and SES-8309386.
1. The role of substitution effects in transfer paradoxes with more than two commodities (and agents) is discussed in a recent piece by de Meza (1983).
 2. An alternative expression often found in the literature involves elasticities of each country's offer curve. The term $\bar{\omega}_A^i$ is literally minus $\left(\frac{p_A}{D_A^i} \frac{\partial D_A^i}{\partial p_A} \right)$ where D_A^i is country i 's demand for A and the partial derivative holds i 's real income constant.
 3. Literally $\gamma > 0$ implies $\sum_{i \in M} \xi_{i,A}^i$ exceeds $\sum_{i \in X} \xi_{i,A}^i$, where the first summation (over importers of A) uses as weights the fraction of total world trade in A represented by i 's imports (exports in the second summation).
 4. An illustration of the presumption towards anti-orthodox trade patterns for the three-country case is provided in Jones (1984).
 5. This paradox was earlier mentioned by Lerner (1936). See also the penetrating discussion of the possibility of these paradoxes (as a consequence of an export tax) in J. S. Mill (1844). In particular note pp. 21-24 of the 2nd edition, 1874.
 6. More recent literature cites other cases in which a country's terms of trade deteriorate as a consequence of a tariff. International capital movements may encourage this result (Jones, 1967) or the production structure may support complementarity in a model with more than two commodities (Gruen and Corden, 1970).
 7. The counter-suggestion put forth by Leontief (1936) was ruled out on stability grounds (for the two-country case) by Samuelson (1947). It has long been recognized that if the transfer directly affects productive resources instead of purchasing power the giver might gain and/or recipient lose. (See the discussion in Jones (1967)). Not discussed in the present paper is the transfer literature that considers non-traded goods markets, a sample of which would include McDougall (1965), Samuelson (1971), Chipman (1974), and Jones (1975).
 8. The discussion of the welfare effects of transfer in the two-country setting in various editions of Caves and Jones has used the technique of examining the state of the market at the price that would leave one party's welfare unchanged. Only substitution terms are left if the other party to the transfer is the only other trader--the case which obtains in a two-country setting, or, in the present context, if U 's trade volume is negligible.

9. Further results for the three-country transfer problem can be derived by distinguishing between gifts involving countries at opposite ends of the taste spectrum and gifts between an extreme country and a country in the middle of the taste spectrum. See Jones (1984). Transfer results when many countries are directly involved are presented by Dixit (1983).
10. In the earlier discussion of the Metzler paradox summarized in criterion (4) tastes were uniform as between private and public sectors at home. If m_A^G and m_A^R are equivalent, γ reduces to the income term in (10).
11. Also familiar is the observation that n_A^h might exceed unity, or might be negative. For example, growth stimulated by expansion of a single factor in a Heckscher-Ohlin context leads to standard magnified effects on the composition of output.
12. Techniques similar to the ones used previously would reveal the criterion for a net loss to the home country (R) which imports A over a given tariff barrier (rate t):

$$\Delta y^R < 0 \quad \text{iff} \quad \underset{(i \neq R)}{S} + (1 + m_A^G t) \underset{(i=R)}{S} < 0.$$

The Giver's marginal propensity to consume A would have to be less than -1 to support such a paradox if the tariff rate is less than 100%.
13. References extend once again back to Edgeworth (1894). In the modern literature this argument has been made by Johnson (1955), Mundell (1960), and stressed by Bhagwati (1968).
14. Their result can be understood by considering the situation utility possibility curve between Giver and Receiver corresponding to the union of the two of them levying an optimal tariff on the third party: it must be negatively sloped. Therefore an increase in the Recipient's welfare must correspond to a reduction in real income for the Giver.
15. Sufficient inferiority in G 's taste pattern could result in home immiserization. As pointed out in private conversations with Richard Brecher, such a result is possible even if an optimal tariff policy is pursued at home if G 's tastes are also sufficiently different from those of other countries in the rest of the world.

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