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Within the standard two-commodity, two-factor trade model, Bhagwati and Srinivasan (1969) examine the changes in the marginal conditions of optimal resource allocation brought about by the addition of a further constraint, a so-called non-economic objective[1], to the familiar technological, resource and foreign-trade constraints. The additional constraint specifies a maximum or minimum level for a single economic variable (imports, domestic production or consumption of one of the commodities, sectoral employment of one of the factors). Therefore, in all four of these cases, the only first-order condition affected is the one with respect to the constrained variable. On the basis of this result two economic propositions are formulated:

> Proposition 1: at fixed foreign prices, "when distortions have to be introduced into the economy, because the values of certain variables (e.g., production or employment of a factor in an activity) have to be constrained, the optimal (or least-cost) method of doing this is to choose that policy intervention that creates the distortion affecting directly the constrained variable."[2]

Proposition 2: in the presence of monopoly power in trade, the optimal policy prescribed under proposition 1 is superimposed upon the standard optimal tariff structure.[3]

Tan (1971) verifies Proposition 1 in three slightly different models involving interindustry flows, imported raw materials and non-traded goods. The only new element introduced by Tan is in the second of these models where he stipulates a minimum level of the domestic value-added within a particular sector. This non-economic constraint specifies the total remuneration of all domestic factors employed in that particular sector and therefore involves both price and quantity variables simultaneously rather than just a single quantity variable as in the Bhagwati-Srinivasan analysis. This new type of non-economic constraint can therefore be expected to lead to qualitatively different conclusions. The specific model employed by Tan, however, is of a nature which fails to bring out the full implications of this type of value-constraint. This question will be dealt with in Section 3.

The present paper treats the theory of non-economic objectives in a multi-commodity framework and is motivated chiefly by two considerations. First of all, the analytically interesting question of a differentiated versus a uniform tax structure obviously cannot be investigated within a two-good model. More importantly, both propositions 1 and 2, partly because they allow clear-cut formulations of guidelines to a planning board, have strong policy implications. Yet, it is obvious that in any practical situation, non-economic objectives of the type investigated by Bhagwati-Srinivasan will have to be specified in terms of aggregates, i.e., in terms of the value (based on some set of prices) of a group of commodities or factors. The prices figuring in this aggregation process may themselves be economic variables. The present analysis allows us to investigate what becomes of propositions 1 and 2 and their policy implications when the variability of these prices is taken into account in the optimization process.

Section 1 considers non-economic objectives which stipulate a maximum or minimum level on value-aggregates which are computed in terms of the fixed foreign prices. Results are obtained analogous to those of Bhagwati-Srinivasan's proposition 1. Section 2 links the analysis to the Lipsey-Lancaster (1956) formulation of the theory of the second best and thus shows concisely the analytical underpinnings and the special nature of propositions 1 and 2. Section 3 treats the case of variable valuation coefficients in the non-economic value-constraint. The theory of non-economic objectives formulated in this way is analogous to a rather well-developed area in fiscal economics pioneered by Ramsey (1927) and Boiteux (1951,1956) and extended in a most elegant and complete fashion by Kolm (1971).[4]

1.

Consider an economy which produces and consumes n final goods, all of which can be traded on the world market at fixed prices. Let C, X and E denote the n-tuples of quantities consumed, produced and imported by the home country and p* the vector of fixed world prices. A central planner maximizes a social utility function, U(C), subject to the market-clearing equations, the domestic production possibility curve and the balance of payments constraint, i.e.,

$$C = X + E \tag{1}$$

$$F(X) = 0 \tag{2}$$

$$p^* \cdot E = 0 \tag{3}$$

and a non-economic constraint of one of the following types:

(i) the net foreign exchange deficit on a certain subset of internationally traded quantities should not exceed a fixed limit, say M_a;

(ii) the total value (at world prices) of the domestic output of a subset of commodities should be kept above a certain minimum level, say M_b; or

(iii) the total domestic consumption expenditure (at world prices) on a subset of commodities should be kept below a given ceiling, say, M_c.

For example, consider constraint (i). Without loss of generality we can partition E into E_α and E_β and p* into p^*_α and p^*_β and express (i) as $p^*_\beta \cdot E_\beta \leqq M_a$. The Lagrangean expression is of the form

$$U(C) - \Lambda\cdot(C-X-E) - \pi F(X) - \phi(p^*\cdot E) - \gamma(p^*_\beta\cdot E_\beta - M_a).$$

The Kuhn-Tucker theorem then states that, with an optimum at all positive c_i and x_i and binding constraint (i), a vector Λ of multipliers $\lambda_1, \ldots, \lambda_n$ and (scalar) multipliers π, ϕ and γ (γ non-negative) exist such that

$$U_i - \lambda_i = 0 \qquad \text{for all } i$$

$$\lambda_i - \pi F_i = 0 \qquad \text{for all } i$$

$$\lambda_i - \phi p^*_i = 0 \qquad i \text{ in group } \alpha$$

$$\lambda_i - \phi p^*_i - \gamma p^*_i = 0 \qquad i \text{ in group } \beta$$

It can readily be seen that these first-order conditions imply (we use good 1 as universal numeraire)

(a) $\frac{U_i}{U_1} = \frac{F_i}{F_1}$ for all i, i.e., no domestic excise taxes on any commodity

(b) $\frac{U_i}{U_1} = \frac{p^*_i}{p^*_1}$ for i in group α, i.e., no tariffs on commodities in the (unrestricted) group α

(c) $\frac{U_i}{U_1} = \frac{p^*_i}{p^*_1}(1 + \frac{\gamma}{\phi})$ for i in group β, i.e., a uniform ad valorem import duty (or export subsidy) at the rate of $\frac{\gamma}{\phi}$ on all traded quantities of commodities in group β.

The ratio $\frac{\gamma}{\phi}$ is non-negative (if the constraint is binding then $\gamma \geq 0$ and if there is no satiation then $\phi > 0$). It can be interpreted as the (shadow) percentage premium on the "privileged" (i.e., usable on group β) foreign exchange. If the inequality in (i) had been reversed, i.e., $p^*_\beta \cdot E_\beta \geqq M_a$, and were binding then the associated multiplier γ would have been non-positive. The percentage $\frac{\gamma}{\phi}$ could then be interpreted as the (shadow) percentage discount on foreign exchange tied to commodities in group β.

The non-economic objecties (ii), $p^*_\beta \cdot X_\beta \geqq M_b$, and (iii), $p^*_\beta \cdot C_\beta \leqq M_c$, can be handled in a similar fashion with the following results:

(1) if the objective is to keep the total production value (at world prices) of a subset of commodities above a certain level, then the optimal policy is characterized by the absence of tariffs and consumption taxes, a uniform ad valorem production subsidy on commodities in the protected group and no subsidy on the commodities outside the protected group.

(2) if the objective is to keep the total value (at world prices) of consumption of a certain group of commodities below a given ceiling, then the optimal policy is characterized by the absence of tariffs and production taxes, a uniform consumption tax on the commodities within the restricted group and no taxes on the commodities outside the group.

2.

This section, in the spirit of the Lipsey-Lancaster formulation of the theory of the second-best (of which the theory of non-economic objectives in international trade is obviously a special case), outlines briefly the analytical underpinnings of the Bhagwati-Srinivasan-Corden result and its analogue in the previous section.

Consider the maximization of U(C) subject to the market-clearing equations (1), the domestic production possibility surface (2), a general foreign offer surface implicitly represented by

$$\Phi(E) = 0 \tag{4}$$

and a completely arbitrary ("non-economic") constraint of the general form

$$G(C,X,E) = 0. \tag{5}$$

At an optimum point multipliers λ_i, π, ϕ and γ exist such that

$$\Lambda' = U_C + \gamma G_C = \pi F_X + \gamma G_X = \phi \Phi_E + \gamma G_E \tag{6}$$

where the subscripted function symbols represent the full or partitioned jacobians (row vectors in this case) of the functions. Any second-best theorem is, in its broadest sense, a statement as to how equations (6) will differ in form from the first-order conditions of the maximization problem without the non-economic constraint, namely,

$$\Lambda' = U_C = \pi F_X = \phi \Phi_E \ . \tag{7}$$

If γ is non-zero, then the answer to that question depends, in an obvious way, entirely on which of the 3n partial derivatives of G are zero. The fact that (6) indicates that, in general, all of the first-order conditions (7) can be affected is in essence the (negative) message of the Lipsey-Lancaster paper.

Now in the Bhagwati-Srinivasan analysis G is the identity function on a single economic variable which leads to the particularly strong propositions 1 and 2. In a slightly more complicated case, e.g., where G involves only a subset of the production variables, say X_β, conditions (6) will imply

$$\frac{U_i}{U_1} = \frac{F_i}{F_1} \qquad \text{i in group } \alpha \tag{8}$$

$$\frac{U_i}{U_1} = \frac{F_i}{F_1} + \frac{\gamma G_i}{U_1} \qquad \text{i in group } \beta \tag{9}$$

$$\frac{U_i}{U_1} = \frac{\phi_i}{\phi_1} \qquad \text{for all i .} \tag{10}$$

This solution still displays the essentital features of the Bhagwati-Srinivasan-Corden results: a production tax-subsidy structure is imposed only on outputs in group β, there are no consumption taxes and the only tariffs are the ones implied by (10), namely the same standard optimal tariff structure as in the absence of any non-economic constraint. As to the question of uniformity of the tax structure within group β, taxes will be uniform if and only if the partial derivatives G_i (i in group β) are proportional to the U_i. This was the case in Section 1 where the value-constraint was computed at fixed foreign prices.

3.

In Section 1 results were obtained analogous to those of Bhagwati-Srinivasan in the two-sector model. This was clearly attributable to the fact that fixed foreign prices were used as weights in the value constraint: the kind of complicating interdependencies discussed in Section 2 were thereby avoided and the value-aggregate in the non-economic constraint behaves essentially as a Hicksian composite commodity which leads to a simple uniform tax structure.[5]

The use of fixed foreign prices as weights in the value-aggregate may, however, in some circumstances be either unfeasible or inappropriate. Consider, for example, a constraint imposed on the total value of the domestic output of a group of commodities some of which are not traded on the world market. Because a world price for these commodities is obviously unavailable domestic prices must be used as weights. But these domestic prices in a general equilibrium framework are dependent on everything else in the economy and hence a more complicated interdependence exists between the non-economic constraint and the rest of the economy; according to the analysis of Section 2 this may be expected to destroy the simple tax structure of Section 1.

The question remains, however, whether foreign prices if available are appropriate weights in value constraints involving domestic production or consumption. A value-constraint on a subset of consumptions is essentially a limit on that part of the consumers' budget allocated to particular commodities. In these circumstances using domestic consumer prices as weights seems appropriate. Similarly, a constraint on the total value of certain outputs can be interpreted as a maximum or a minimum on total producers' revenue and producer prices seem appropriate wieghts in this case. Whenever variable domestic prices are used in the value constraint the optimal policy will dictate that the variability of these valuation coefficients be exploited. Under such circumstances a new set of recommendations qualitatively different from those implied by propositions 1 and 2 will emerge.

In order to analyze the questions raised above consider a model in which all valuation coefficients entering the non-economic constraint are proportional to the marginal utilities of the social objective function, U(C). Let q denote the vector of consumer prices normalized in a definite way such as to make q a function of C. It is not necessary for our purposes to specify the particular normalization rule used. We shall consider in turn the non-economic constraints

$$q_{\beta}'E_{\beta} \leqq M_a \tag{11}$$

$$q_{\beta}'X_{\beta} \leqq M_b \tag{12}$$

$$q_{\beta}'C_{\beta} \leqq M_c \tag{13}$$

where the subscript β as before refers to the last n-m elements of the vector.

For convenience of notation, define the (n-m) x n Jacobian matrix

$$B \equiv \left[\frac{\partial q_i}{\partial c_j}\right] \qquad i = 1,\ldots,n \text{ and } j = m+1,\ldots,n,$$

with partitions B_1 and B_2 containing respectively the first m columns and the last n-m columns of B. The symbols U_α and U_β indicate the appropriate partitions of the gradient U_C. Similarly for F_α and F_β .

The maximization of U(C) subject to (1), (2), (3) and either (11), (12) or (13) then results in sets of first-order conditions (14), (15) and (16) respectively:

$$U_C - \Lambda' - \gamma E_\beta' B = 0 \qquad (14a)$$

$$\Lambda' - \pi F_X = 0 \qquad (14b)$$

$$\Lambda_\alpha' - \phi p_\alpha^{*\prime} = 0 \qquad (14c)$$

$$\Lambda_\beta' - \phi p_\beta^{*\prime} - \gamma q_\beta' = 0 \qquad (14d)$$

$$U_C - \Lambda' - \gamma X_\beta' B = 0 \qquad (15a)$$

$$\Lambda_\alpha' - \pi F_\alpha = 0 \qquad (15b)$$

$$\Lambda_\beta' - \pi F_\beta - \gamma q_\beta' = 0 \qquad (15c)$$

$$\Lambda' - \phi p^* = 0 \qquad (15d)$$

$$U_\alpha - \Lambda'_\alpha - \gamma C'_\beta B_1 = 0 \qquad (16a)$$

$$U_\beta - \Lambda'_\beta - \gamma(C'_\beta B_2 + q'_\beta) = 0 \qquad (16b)$$

$$\Lambda' - \pi F_X = 0 \qquad (16c)$$

$$\Lambda' - \phi p^{*\prime} = 0 \quad . \qquad (16d)$$

Comparing these three sets of first-order conditions we can make the following general observations:

(i) in all three cases a differentiated consumption tax (subsidy)[6] structure is imposed reflecting the elasticities of the valuation coefficients q_i ($i = m+1,\ldots,n$) appearing in the non-economic constraints. These consumption taxes are in general imposed on all commodities (not just those in the non-economic constraint) due to the fact that the prices q_i are functions of all quantities consumed. The size of the specific consumption tax is proportional to the marginal change in the total value of the commodities in group β as a result of changing valuation coefficients q_i.

(ii) in addition to this consumption tax structure a second tax structure is imposed but only on the commodities appearing in the non-economic constraint. This tax structure consists of consumption taxes, production taxes or tariffs depending on whether the quantities appearing in the non-economic constraint are quantities consumed, produced or traded.

(iii) this second element (described in ii) of the tax structure is proportional to the valuation coefficients q_i.

Hence, whether or not it introduces a further element of uniformity or differentiation depends on the non-economic constraint in question. For example, in the case of constraint (13) since q_β is proportional to U_β equation (16b) can be written as

$$U_\beta(1 - k\gamma) - \Lambda'_\beta - \gamma(C'_\beta B_2) = 0$$

where k is a constant (depending only on the normalization rule used for the consumer prices). Therefore, in the case of a consumption value constraint this second element of the tax structure is uniform. The same thing of course cannot be done with equations (14d) and (15c) so that in the first two problems a further element of differentiation is introduced for the commodities entering in the non-economic constraint.

Attention can also be drawn to the fact that constraint (13) preserves aggregate production efficiency as indicated by equations (16c-16d) while constraints (11) and (12) impair the aggregate production efficiency (i.e., the economy produces inside the so-called Baldwin envelope). This latter feature is the consequence of the fact that constraints (11) and (12) relate to one of two production units separately (domestic transformation or transformation through trade). It is completely analogous to the situation where the domestic production is disaggregated and a constraint is imposed on a single firm in the economy.[7]

Of course, value-constraints of the type (11-13) can also be analyzed with q_β replaced by p_β, where p is defined as proportional to the gradient, F_X, of the domestic transformation function and normalized in a particular way. Mutatis mutandis, first-order conditions, analogous to the sets of condtions (14), (15) and (16) will be obtained which take into account the variability of the valuation coefficients p in the non-economic constraints.

It remains to comment briefly on the influence of monopoly power in trade and essentially to verify proposition 2 in this context. Under monopoly power in trade, foreign prices, p_i^*, are functions of E and the balance of payments equation (3) becomes a value-constraint with variable coefficients. Using the notation

$$M \equiv \left[\frac{\partial p_i^*}{\partial E_j}\right] \qquad i,j = 1,\ldots,n$$

it is obvious that under monopoly power in trade p*', whever it appears in the sets of equations (14), (15) and (16), would be replaced by p*' + E'M. This implies indeed that in the case of monopoly power in trade a standard optimal tariff structure is superimposed upon whatever tax structure is required by the non-economic constraint in the absence of monopoly power. Hence, Bhagwati-Srinivasan_Corden's proposition 2 continues to hold when combined with appropriate modifications of proposition 1.

4.

In summary when non-economic constraints are imposed involving value-aggregates, the resulting tax structure can essentially be broken down into the following components:

(i) a differentiated tax structure on all commodities reflecting the variability of the valuation-coefficients in the non-economic constraint. This tax structure will consist of consumption-, production- or trade taxes depending on whether the valuation coefficients used in the non-economic constraint are consumer-, producer- or foreign prices.

(ii) a tax structure imposed only on the subset of quantities whose total value is being constrained. These taxes are proportional to the valuation coefficients of the non-economic constraint.

(iii) a standard optimal tariff structure if monopoly power in trade is present.

Footnotes

*I am indebted to Jagdish Bhagwati for the suggestion that I investigate this problem and for many helpful discussions on the topic. I had the benefit of lengthy conversations on the matter with James Anderson and Harriet Tolpin. No implications intended. The final version of this paper was prepared while I was visiting M.I.T.; financial support from the NSF Grant GS-2978 is acknowledged.

[1]The way the analysis is carried out, both in the present paper and in Bhagwati-Srinivasan(1969) the term non-economic constraint is analytically the more accurate one. The term non-economic objective, coined by Bhagwati-Srinivasan, derives from the fact that whoever imposes an extraneous constraint on economic policy obviously must ultimately base this action upon some political objective which, for right or for wrong, is thought of as superseding all questions of purely economic allocation. In fact this is exactly what is formalized mathematically in Bhagwati-Srinivasan's Section III. Both terms will be used interchangeably in the present paper.

[2]This statement is quoted from Bhagwati (1971,p.77). A survey of related literature can also be found there.

[3]This proposition was originally formulated for the case where the non-economic objective is a minimum level of the domestic production of the importable in a seminal article by Corden (1957). For a description of optimal tariff structures in the context of many commodities, besides the classic article by Graaff (1949) and the textbook expositions by Kemp (1964, 1969), probably the most recent and complete investigation of the structure of optimal tariff rates has been carried out by Horwell and Pearce (1970).

[4]This last reference was brought to my attention by James Anderson while I was working on the final version of this paper.

[5]It is essentially the same feature which lets Tan (1971) obtain similar results in the case of a constraint on the value of total factor payments in a single sector. While the valuation coefficients (wage and rental rate) are domestic price-variables, in the model employed (2 sectors, 2 primary domestic factors, 1 imported input), they are (by the factor-price equalization theorem) fixed cnce the foreign prices are fixed.

[6]Taxes can obviously be positive or negative. In the sequel the term "tax" is to be understood in an algebraic sense.

[7]Hence, although the present analysis does not disaggregate the domestic economy to consider non-economic constraints on sectoral employment of factors as does the Bhagwati-Srinivasan analysis, insights into those problems can be gained from a consideration of constraints (11) and (12).

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