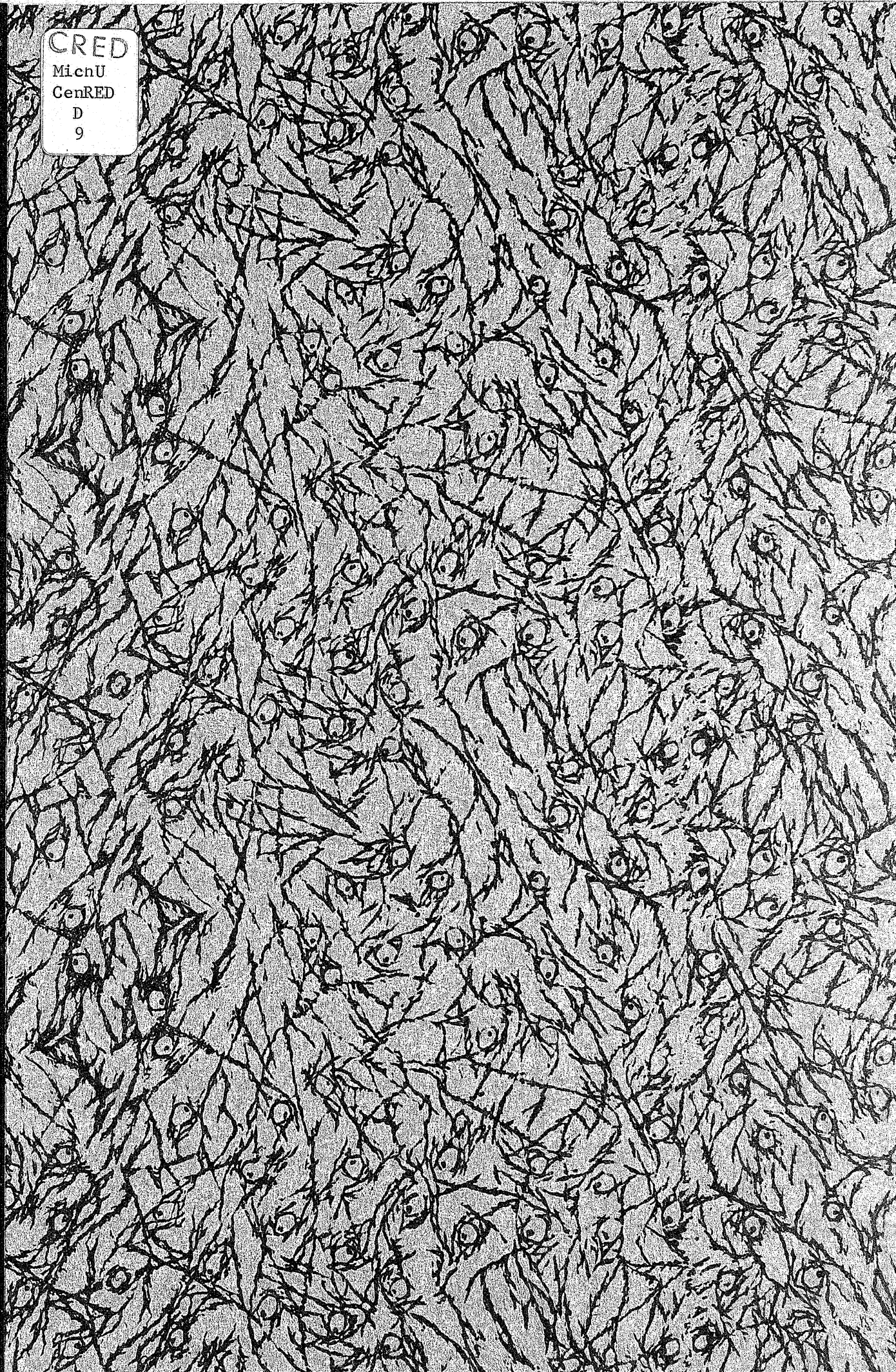
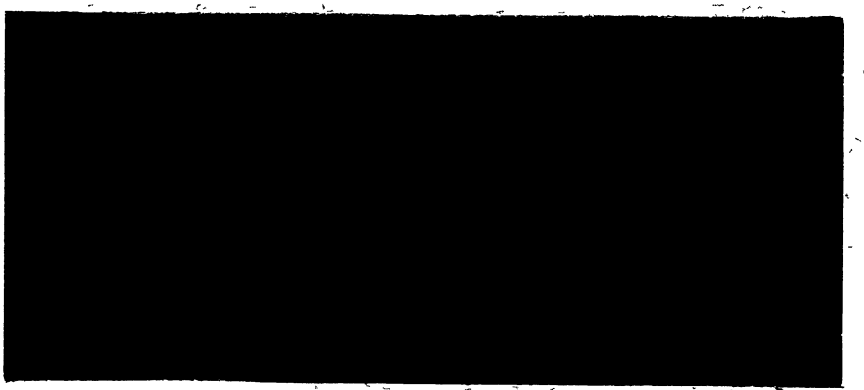


Center for Research on Economic Development

University of Michigan
Ann Arbor, Michigan 48104



Toward an Integrated Theory of Tariffs

by

Peter Eckstein

9

August 1969

Center for Research on Economic Development
University of Michigan
Ann Arbor, Michigan 48104

Discussion Paper No. 9

Toward an Integrated Theory of Tariffs*

Economists have long recognized that the effects of a single tariff are numerous. In his textbook on international trade C. P. Kindleberger cites eight: on production, consumption, government tax revenue, terms of trade, balance of payments, income distribution, aggregate demand, and competition. [(1968), Chapter 7]. The analysis of optimal tariff policy, however, has typically considered only one or two of these effects at any one time. For example, there is the "optimum tariff" to improve the terms of trade [Bickerdike (1906), Scitovsky (1941-42), Kahn (1947-48), Graff (1949-50)]; the subsidy (rather than a tariff) to provide some industries with protection without distorting consumption [Bhagwati and Ramaswami (1963), Johnson (1965]; the uniform export subsidy and import tariff to restore the balance of payments in the face of institutional or political rigidities in the exchange rate [Keynes (1931), Haberler (1967)]; and the tariff to provide a maximum or specifi amount of revenue for the government [Johnson (1951-52), Ramaswami and Srinivasan (1968)]. For the developed economies, where few of these problems are likely to be salient at any particular time, this may be an adequate approach. However, for the underdeveloped economies, which are the particular concern of this paper, each of the effects of a tariff may be important to the success of development efforts. Given that each good can only bear one tariff, the level of that single policy instrument must be chosen in light of its many simultaneous effects on the economy. This paper, then, seeks ways in which tariff theory can be rendered more relevant to the real dilemmas of economic policy.

We will not be concerned here with aggregate demand effects, relating as they do to problems of Keynesian unemployment, which are rare in the under-

*I am grateful to Wolfgang Stolper and Richard Porter for critical readings of earlier drafts.

developed economies and susceptible to more direct treatment in the developed. We will only summarily discuss how competitive effects may be related to the larger analysis. We will, however, derive single formulas for the after-tax prices of both exports and imports which balance off the welfare implications of the production, consumption, tax revenue, distributional, terms-of-trade, and balance-of-payments effects.

In Section I we state some basic assumptions. In Section II we analyze the case in which there are only final goods and the government can use only general trade policy--exchange rates and taxes (or subsidies) on imports and exports--to influence their domestic production and consumption. In Section III we will continue to deal only with final goods but consider the use of separate taxes (and subsidies) for domestic production and consumption. In Section IV we will consider the implications for the analysis of distinguishing between intermediate and final goods.*

I. Framework and Assumptions

A. Welfare premiums

The technique of this paper will be to maximize a domestic welfare function-social benefits (B) minus social costs (C)--subject to a balance-of-payments constraint. The social costs term will consist of the private costs of production. The social benefits term will include, in addition to the private benefits of consumption, three welfare premiums--on government revenue and on particular forms of final use ("consumption") and of production.**

---

*Earlier explorations of the techniques described in the paper--including some of the results described in Section II--are presented in two earlier papers, Eckstein (1969 a) and (1969 b).

**We will not consider the difficult problems of determining the size of these premiums, only the ways in which they are logically related to the optimal levels of tariffs. The three premiums are each treated as constants, implying either that required adjustments will be small enough that diminishing marginal returns will not set in or that their levels in an optimum solution can be anticipated (or successively approximated).

These premiums, when positive, represent the social benefits of an activity in excess of its market value; assigning such a premium implies that the government is prepared to inflict equally heavy social costs in order to realize those benefits. The revenue premium is assumed to be non-negative. While we will usually treat the consumption and production premiums as positive, in practice they are as likely to be negative as positive for any particular category of goods.

i) Premium on Revenue

From the empirical literature on taxation in underdeveloped economies it is possible to draw two clear conclusions: (1) governments typically find greater political and administrative difficulties in collecting taxes on purely domestic activities than on international trade; and (2) these difficulties often force a heavy reliance on a limited number of revenue sources (or inflationary finance), to a point where their combined distributional, allocative, and collection costs become appreciable.* The first conclusion makes more plausible our assumption that governments can use trade taxes alone--rather than separate taxes on production and use--to influence the domestic prices of goods. The second supports the idea that the government should attach a welfare premium (β) to its own revenue.

---

*Trade taxes were a primary source of revenue in the early United States [Petersen and Gray (1969), p. 96] and in Latin America in modern times [Macario (1964), pp. 61, 65]. Many students of public finance in Asia and Africa today describe a preference for import and export taxes because of their "ease of collection" or "administrative convenience." [See, for example, Ursula Hicks (1965), p. 71; Due (1962), pp. 83-84; Martin and Lewis (1956), p. 225; Goode, Lent and Ojha (1966), p. 477]. In the words of the latter, "Generally...where export duties are important, the more refined taxes on income, profits, or land values are not realistic alternatives for the present or near future." For some specific difficulties in collecting non-trade taxes, see, for example, Paauw [(1960), p. 373] on Indonesia and Higgins [(1968), p. 293] on Lebanon. On the general inadequacy of revenue, due to lack of "taxable capacity" and "necessary political consensus," see Johnson (1967), p. 126. Two recent cross-section studies show that the "openness" of the economy--as measured by the ratio of imports to GNP--is a powerful predictor of the share of government revenue in GNP, especially for countries in which GNP per capita is below $150. [See Tanzi and McCustion (1967) and Roe (1968)].

The revenue premium implies that the government should carry each form of taxation up to the point at which its (increasing) marginal cost exceeds marginal revenue by the proportion β, and that it should pursue each line of expenditure only to the point at which its (declining) marginal benefit exceeds marginal cost by the same proportion.* If, as we have suggested, the revenue premium is large, then expenditure projects would be rejected even if their benefit-cost ratios were substantially greater than one, and taxes on foreign trade (and other sectors) would be tolerated even if they entailed substantial private costs.

ii) Premium on Use

There are several reasons why a government might wish to assign a welfare premium (γ_i) to the final use (or "consumption") of goods in a particular category (i). In the first place, encouraging the consumption of wage goods at the expense of luxury goods can be a means of improving a highly inequitable distribution of income when more direct methods--e.g., transfer payments--are infeasible.** In the second place, lowering the relative prices of investment goods can be a means of increasing the share of saving and investment in the domestic product. In addition, the consumption premium might be used to recognize externalities in consumption or to take account of

---

*This is a restatement of the Pigou-Dalton criterion for rationality in public finance. See, for example, Musgrave [(1959), pp. 113-4].

**If the government's ability to redistribute income is unconstrained, then the premium society places on redistribution can be fully reflected in the value assigned to β, the premium on government revenue. More likely there will be limits on the ability to redistribute the real income generated by factor incomes from production and relative prices of consumption goods. For example, Pakistan might find it easier to improve the relative income of the rice-eating eastern wing as against the wheat-eating western wing through price policy to stimulate rice consumption than through direct redistribution. Hirschman [(1967), p. 171] characterizes the policy environment in underdeveloped economies as "non-Nelsonian"--in which it cannot be expected that all agencies of government have been able to do their duty with respect to social problems, so that the amelioration of them must often "ride the coattails" of "privileged problems."

what Musgrave calls "merit wants" [(1959), pp. 13-14]. We define the consumption premium in domestic value per marginal unit of consumption.

iii) Premium on Production

Insofar as production in a particular sector generates social benefits in excess of the private benefits to producers, the government will wish to attach a welfare premium (α_i) to that production (expressed in domestic currency per marginal unit of production). Since underdeveloped economies are unlikely to have explored and become established in the areas of their long-run comparative advantage, the largest component of a particular welfare premium will probably be the external benefits (current and future) of the costly process of acquiring experience at production.* Other components might include any genuinely external benefits from backward or forward linkages, the social value of income redistribution toward (or away from) specialized factors of production, and such non-economic considerations as national pride or defense. With given resource constraints in the economy, however, the production premium for a particular sector must be viewed relative to the other sectors; a positive premium should be assigned only if there is a net social gain expected from shifting resources out of other sectors into this one.

B. Policy equivalents

In analyzing the implications for trade policy of these welfare premiums, it is useful to assume that the government: (1) through exchange rate policy,

---

*Insofar as present producers expect to be able to recover the benefits of future cost reductions, their current market actions will be represented by supply curves to the right of current marginal cost curves; this will be a divergence not between private and social marginal cost but between short-run and long-run private marginal costs, the latter being corrected by a discounted stream of future benefits of current production.

If there are adverse "competitive effects" of the tariff--e.g., if domestic industries will lose some incentive to reduce costs as a result of their insulation from world competition--the values of the αs should be reduced accordingly. (A better approximation of this effect, however, would make it a function of the expected time path of domestic prices.)

specific taxes and subsidies on traded goods, and any autonomous capital flows, maintains a balance on the external accounts; (2) is fully effective in collecting any taxes (and granting any subsidies) on particular traded goods;* (3) insures, through either a monopoly on foreign exchange transactions or controls on capital flight, that domestic export earnings continue to be spent on domestically taxable imports, despite variations in tariff levels; and (4) does not impose direct quantitative restrictions on consumption, production, or trade.

It is now unnecessary to specify beforehand what portion of a particular domestic price is the world price converted at the exchange rate and what portion is attributable to a supplementary tax, subsidy, or system of multiple exchange rates. Rather, we may recognize a general rule of equivalence: under these assumptions any system of taxes, subsidies, and official exchange rates that generates a given set of effective domestic prices to producers and to users of traded goods will have identical implications for domestic production and use and for net government revenues.**

---

*In one form or another this assumption is implicit in much of modern trade the(It precludes, of course, both administrative inefficiencies and smuggling, a phenomenon deemed empirically important both by students of Europe in the 18th century [Smith (1789), pp. 832-7] and of underdeveloped economies in the 20th century [Berg (1964), pp. 566-570, and Hicks (1965), pp. 72-3].

**This rule is implicit in much of the existing body of trade theory. One examp would be Lerner's proof (1936) that a general export tax is the equivalent of a general import tariff; the argument, if translated into monetary terms, would be that a different equilibrium exchange rate in each case renders the two sets of effective (after tax) prices identical. Other examples would be: Keynes' proposition (1931) that a general import tariff combined with a comparable general export subsidy is the equivalent for traded goods of a devaluation; the similarity between systems of multiple exchange rates and systems of differentiated export and import taxes [e.g., Meade (1951), pp. 268-272]; or the ability of a government monopoly on foreign trade to duplicate the effects of such taxes [Enke (1944), p. 244]. When administrative feasibility is taken int account, some methods of enforcing a set of effective prices might prove more efficient than others. Centralization of production units, for example, might make export taxes easier to enforce directly than through currency values; limited points of entry into the country might make import taxes easier to enforce directly. For a useful discussion of this point, see Meade [(1951), pp. 272-275].

This rule holds for production and consumption, because the government determines the domestic prices of all foreign exchange transactions, and producers and consumers can respond only to these. The rule also holds for tax revenues. At one level we might see revenues from trade as the net proceeds from a welter of specific taxes and subsidies on traded goods and from the departures of multiple exchange rates from some "basic" rate, When revenues are viewed in the context of effective taxes and a government-maintained exchange rate, however, the picture simplifies. In effect, when exporters sell abroad the government receives dollars from them and rewards them with domestic currency; and when importers purchase abroad the government provides them with dollars and charges them in domestic currency.* Government revenue in domestic currency is thus the difference between the total amount importers pay for the goods they use and the total amount exporters are paid for the goods they produce, whether or not taxes are explicitly recognized as part of either total.**

II. Taxes Confined to International Trade

The assumptions of the previous section--and some others that will be added here--can be expressed more formally.

We assume that all categories of final goods (subscripted i when not further defined) can be separated into importables (subscripted j), exportables (subscripted g), and non-traded goods. Particular goods are assumed not to cross over as a result of the pattern of taxes and subsidies. Physical quantities of a category of imports (m_j) are defined as the excess of domestic use

---

*This is not, however, to preclude the possibility that the government uses bank or other private intermediaries to buy and sell the dollars at a fixed price ar directly charges (or provides) only the tax (or subsidy) elements of the total

**If, contrary to our assumption, the dollar accounts did not balance, we could see the government as earning domestic revenue at the expense of foreign exchar reserves or short-run indebtedness abroad.

or "consumption" (c_j) over domestic production (q_j), and exports (e_g) as the excess of domestic production (q_g) over domestic consumption (c_g). When the generalized notation is used, all traded amounts are denoted as imports (m_i), but negative values represent exports. Thus,

(1) $\quad m_j = c_j - q_j;\ e_g = q_g - c_g;$ or: $m_i = c_i - q_i.$

We further assume that the basic income level of the economy is determined in the short run by its supplies of factors, and that each individual producer takes factor prices as given. We assume that the domestic revenue of the government is spent only on non-traded goods, and that the income effects of taxation of a good (beyond that reflected in the demand curve for that good) fall entirely on the demand for non-traded goods.* We also assume away any cross-elasticities of demand for traded goods.** Domestic consumption and production of traded goods, then, may each be treated as functions only of their own prices.

(2) $\quad c_i = c_i\ (p_i);\ q_i = q_i\ (p_i)$

Supply curves are assumed to be upward sloping,*** and demand curves downward sloping:

(3) $\quad dq_i/dp_i > 0;\ dc_i/dp_i < 0$

Private benefit in the economy from the consumption of a category of goods (B_i) is assumed to be a function only of the quantity of that consumption. The private (non-rent) cost of the production of a category of goods (C_i) is assumed to be a function of the quantity of production alone:

(4) $\quad B_i = B_i(c_i);\ C_i = C_i\ (q_i)$

---

*For example, we might see increased government taxation and expenditure as a process of converting private servants into public servants.

**The effect of relaxing this assumption is noted in the subsection on consumption tariffs.

***A good deal of empirical evidence for the upward-sloping supply curve in export production in underdeveloped economies is marshalled by Good, Lent, and Ojha [(1966), pp. 466-471].

Consumers and producers are assumed to act as atomistic maximizers of utility and profits respectively,* equating the marginal private benefit and cost of each good to its domestic price:

$$(5) \qquad dC_i/dq_i = dB_i/dc_i = p_i$$

Government revenue from trade (R) is, as explained in Section I, the difference between the domestic value of imports and the domestic value of exports:

$$(6) \quad R = \sum_j p_j m_j - \sum_g p_g e_g = \sum_i p_i m_i$$

World market prices for each category of goods may be an increasing function of the quantity of goods imported or a decreasing function of the quantity of good exported:

$$(7) \quad \pi_j = \pi_j (m_j); \ \pi_g = \pi_g (e_g); \ \pi_i = \pi_i (m_i)$$

$$(8) \quad d\pi_i/dm_i \geq 0$$

We assume that the marginal private costs of production consist entirely of payments to mobile factors of production at rates of return which just maintain their full employment, and that the use and remuneration of mobile factors in and of themselves entail no externalities. Social costs (C) may then be treated as consisting entirely of those private costs of production

---

*It is often argued that highly protected firms are free to engage in monopolistic practices. When, however, we assume that tariffs (rather than quantitative restrictions) are the sole means of import exclusion, then the domestic price for a homogeneous commodity must be the world price c.i.f. plus the tariff. Even a pure monopolist becomes a price taker (in his market, if not his political, behavior), since his customers always retain the ability to import.

(C_i) which are dependent on the levels of production of particular goods:*

$$(9) \quad C = \sum_i [C_i(q_i)]$$

Marginal social benefits are assumed to include--in addition to the private benefits of consumption--the welfare premiums on consumption, production, and revenue. Thus:

$$(10) \quad dB/dc_i = dB_i/dc_i + \gamma_i$$

$$(11) \quad dB/dq_i = \alpha_i$$

$$(12) \quad dB/dR = \beta$$

and the term for social benefits (B) can be expressed as the sum of these four categories.

$$(13) \quad B = \sum_i [B_i(c_i) + \gamma_i c_i + \alpha_i q_i + \beta p_i m_i]$$

A constraint on the solution is assumed to be equilibrium in the balance of payments. Thus, total imports in dollars (M) must equal total exports in dollars (E), or:

$$(14) \quad M - E = \sum_j \pi_j m_j - \sum_g \pi_g e_g = \sum_i \pi_i m_i = 0$$

We may solve for the optimal price of a particular category of goods by maximizing a welfare function (V), which consists of social benefits less social costs less a Lagrangian multiplier (λ) times the zero value of the balance of payments constraint:

$$(15) \quad V = B - C - \lambda [M - E] = \sum_i [B_i(c_i) + \gamma_i c_i + \alpha_i q_i + \beta p_i m_i - C_i(q_i) - \lambda \pi_i m_i]$$

---

*When we maximize a welfare function including such a cost term, partial differentiation yields a marginal cost term, representing the sum across all factors of the full-employment factor price times the marginal factor requirement of a unit of production. Alternatively, we might omit any explicit cost term and maximize the welfare function subject to a set of Lagrangian multipliers times the zero values of a set of factor supply constraints. Differentiation would then yield, in place of the marginal cost of production, a series of terms representing the marginal factor requirements of production times the Langrangi multipliers of the respective factor constraints. When the multipliers are interpreted as the opportunity costs of the factors, the two approaches may be seen to yield the same results.

The social cost and benefit terms both omit arbitrary constants of integration.

Maximizing with respect to a particular price (p_i),* we obtain:

$$(16)\quad p_i\left(1+\beta+\beta/\frac{dm_i/dp_i}{m_i/p_i}\right)=\lambda\pi_i\left[1+\frac{d\pi_i/dm_i}{\pi_i/m_i}\right]-\alpha_i\frac{dq_i/dp_i}{dm_i/dp_i}-\gamma_i\frac{dc_i/dp_i}{dm_i/dp_i}$$

Converting this expression into the prices of a typical import good (p_j) and typical export good (p_g), we obtain:

$$(17)\quad p_j=\frac{\lambda\pi_j\left[1+1/\epsilon_{mj}\right]+\alpha_j\left|\frac{dq_j/dp_j}{dm_j/dp_j}\right|-\gamma_j\frac{dc_j/dp_j}{dm_j/dp_j}}{1+\beta-\beta/\eta_{mj}}$$

$$(18)\quad p_g=\frac{\lambda\pi_g\left[1-1/\eta_g\right]+\alpha_g\left|\frac{dq_g/dp_g}{de_g/dp_g}\right|-\gamma_g\frac{dc_g/dp_g}{de_g/dp_g}}{1+\beta+\beta/\epsilon_{eg}}$$

where the ratios of the derivatives are expressed as absolute values and the world and domestic elasticity terms are defined to be positive:

$1/\eta_{eg} \equiv -\frac{d\pi_g/de_g}{\pi_g/e_g}$ = reciprocal of the net world demand elasticity for a category of exports

$1/\epsilon_{mj} \equiv \frac{d\pi_j/dm_j}{\pi_j/m_j}$ = reciprocal of the net world supply elasticity of a category of imports

$1/\eta_{mj} \equiv -\frac{m_j/p_j}{dm_j/dp_j}$ = reciprocal of the net domestic demand elasticity for a category of imports

$1/\epsilon_{eg} \equiv \frac{e_g/p_g}{de_g/dp_g}$ = reciprocal of the net domestic supply elasticity for a category of exports

These two prices, then, incorporate those taxes (or subsidies) which maximize net social welfare, where welfare is a combined function of the patter

*We obtain our result by differentiating with respect to (p_i), setting the result equal to zero, dividing the resulting expression by dm_i/dp_i and substituting p_i for dC_i/dq_i and dB_i/dc_i.

of production, the pattern of consumption, the quantity of government revenue, and the international terms of trade, and is constrained by the requirement of balance of payment equilibrium.

The meaning of the complete price expressions may be most readily understood by isolating each component in turn.

A) Balance of payments

In the simplest case, in which the country exerts no power on world markets for a good and there are no welfare premiums, or:

$$\beta = \alpha_i + \gamma_i = 1/\epsilon_{mj} = 1/\eta_{eg} = 0 \quad , \text{ then:}$$

$$(16a) \quad p_i = \lambda \pi_j$$

The Lagrangian multiplier, λ , may be seen as that ratio between world prices and domestic prices which maintains the balance of payments constraint--in other words, the equilibrium exchange rate. Pure balance-of-payments policy, then, requires no tariffs or subsidies at all, only an appropriate exchange rate.

B) Terms of trade tariffs

If we continue to ignore the three welfare premiums but allow for finite world demand and supply elasticities, we obtain:

$$(16b) \quad p_g = \lambda \pi_g \, [1 - 1/\eta_{eg}]; \; p_j = \lambda \pi_j \, [1 + 1/\epsilon_{mj}]$$

These are familiar expressions for terms-of-trade taxes on exports and imports, most closely resembling those of Lerner (1944) but explicitly including an exchange rate term. Whether the government is seeking to withhold exports in order to raise the world price or to curtail imports in order to lower the world price, the indicated mechanism is a tax on trade--a lower domestic price for exports and a higher domestic price for imports than those indicated by the world price converted at the equilbrium exchange rate.* The

---

*For a discussion and graphical interpretation of this equation, see Eckstein (1969b).

While many underdeveloped economies are highly specialized producers of one

traditional "optimum tariff" can thus be seen as a special case in a more general theory.

C) Protective tariffs

With constant world prices and welfare premiums on production but not on revenue or consumption ($\alpha_i > 0$), any taxes on import and export goods serve only to protect domestic production. Optimal prices then are:

$$(16c)\quad p_j = \lambda\pi_j + \alpha_j \left|\frac{dq_j/dp_j}{dm_j/dp_j}\right| ;\quad p_g = \lambda\pi_g + \alpha_g \left|\frac{dq_g/dp_g}{e_g/p_g}\right|$$

Three features of these prices should be noted. In the first place, a positive protective premium always indicates a domestic price higher than the world price, implemented in the case of imports by a protective tariff and in the case of exports by a protective subsidy.

In the second place, the amount of protection afforded will ordinarily be only a fraction of the protective premium--that share of the marginal change in the quantity of goods traded which results from a change in the quantity of goods produced. The full premium should be offered only if demand were perfectly inelastic and the only social cost of a higher domestic price would be the opportunity cost of the resources drawn into production; if there were consumption costs as well, marginal social costs would become equal to marginal social benefits (the welfare premium on increased production) before the price

---

or two export commodities and are thus able to exert some monopolistic influence on prices in particular world markets, they are not only poor but ordinarily unspecialized consumers and thus unable to influence the world prices of their imports. Zanzibar (Tanzania), for example, may be able to influence the world price of cloves but cannot bid up or down the world price of refrigerators. The only instances of underdeveloped economies exerting monopsonistic influence would probably be ones in which consumers had acquired peculiar tastes for some exotic commodity or in which specialized export producers required imports of some intermediate good. Isolated examples might be Hong Kong, with its strong demand for rhinoceros horn, or India in the immediat post-Partition years, when its jute factories were cut off from traditional sources of raw fiber in the region which became East Pakistan.

had been raised by the full amount.

In the third place, it follows that the optimal protective tariff will not be equal, even across categories of goods with the same basic claim to protection. The country might benefit equally from increased production of any of the goods in a general class--say, manufacturing, or "heavy industry"--but policy should afford the greatest protection to those goods for which the burden of import reduction will be borne most heavily by actual increases in production. In the extreme case in which no production would be inducated, there would clearly be no justification for any purely protective tariff.*

D) Consumption tariffs

If world prices are fixed, and the only welfare premium is that on consumption, optimal prices are:

$$(16d)\quad p_j = \lambda\pi_j - \gamma_j \frac{dc_j/dp_j}{dm_j/dp_j}\ ;\ p_g = \lambda\pi_g - \gamma_g \frac{dc_g/dp_g}{de_g/dp_g}$$

Thus a positive welfare premium on consumption always indicates a lower domestic price, but (as with production) the indicated reduction is ordinarily only a fraction of the premium--the share of the change in the quantity of goods

*For example, El Salvador might benefit equally from the creation domestically of a textile mill or a computer plant producing goods of equal value at world prices. The implication of Equation (18) is that if a higher tariff on textile would primarily serve to stimulate production, while a higher tariff on computer would primarily serve to curtail consumption, the "infant industry" argument would justify only the higher tariff on textiles.

By contrast, Haberler [(1959), p. 36] argues that "a uniform import tariff on manufactured goods, or on broad categories of such goods, is probably the best method of infant industry protection. This leaves the selection of the commodities actually produced to the forces of the market." The point here is that a tariff system that ignored differences in the ability of the market to induce production in all fields--and included protective tariffs even where increased production was impossible--would impose an undue burden on consumers (In an unpublished paper, Harberger (1969) also argues for uniform protective tariffs, but he explicitly ignores consumption costs.) Johnson has argued for differentiated protective tariffs, correctly but in a less general context [(1960), pp. 341-343], and incorrectly [(1964), pp. 13-19]. On the latter, see my critique (1969a), partly using the techniques of this paper.

imported which results from a change in the quantity of goods consumed.*

Thus, low tariffs (or subsidized exchange rates) for imported capital goods are more efficient means of encouraging investment where they do not at the same time hinder the development of a domestic capital goods industry. Likewise, high tariffs on imports of luxury goods are a more efficient means of redistributing real income where they do not primarily serve to stimulate domestic production.**

If we were to generalize the analysis by relaxing the assumption that the consumption of a good is function only of its own price, the optimal price would include, inter alia, some positive recognition of any consumption premiums on substitute goods and some negative recognition of any consumption premiums on complementary goods.***

---

*The multiplier of the consumption premium is the complement of the multiplier of the productive premium. Thus, when the consumption premium is negative and the production premium is positive, Equations (17) and (18) together indicate a price increase which is the weighted average of the two terms.

**Existing tariff structures in many underdeveloped economies can be faulted on both points. See, for example, Power [(1963, pp. 199-204] on Pakistan and Macario (1964) on Latin America.

***Recognizing cross-elasticities means differentiating the welfare function of Equation (15) with respect to the price of some particular good i, say P_1, while taking into account the impact of that price on the consumption of all other goods, say i = 2, 3...M. We obtain an optimal p_1 which contains all the elements of the right-hand side of Equation (16) expressed entirely in terms of good 1, plus an expression:

$$+ \sum_{i=2}^{M} \frac{dc_i/dp_1}{\left|dm_1/dp_1\right|} \quad [p_i - \lambda\pi_i \ [1 + 1/\epsilon_{mi}] + \gamma_i + \beta p_i$$

The fractional term says that a positive consumption effect for each good $i \neq 1$ should be taken into account to the extent that an increase in consumption of the good is associated with a decrease in the imports of good 1 (induced by an increase in its price). (Since the domestic production of the other goods is unaffected by the price of good 1, an increase in consumption is equivalent to an increase in imports.) For each other good i the consumption effect (the bracketed term) consists of: the marginal private benefit of increased consumption [p_i]; less the net foreign exchange cost of additiona imports ($\lambda\pi_i \ [1 + 1/\epsilon_{mi}]$); plus the social premium on that consumption [γ_i]; plus the additional revenue generated by the additional imports [βp_i].

If, for example, the relatively harmless consumption of beer is all that prevents increased consumption of the demon rum, with its adverse social consequences (a negative γ_i), this should help keep down the optimal price of bee

E) Revenue tariffs

The tariffs (or subsidies) indicated by the terms-of-trade, production, and consumption effects are all additive. Recognition of revenue benefits, however, entails a proportionate change in the domestic price indicated by the world price plus those three tariffs. The proportion is a function of the revenue premium (β):

$$\frac{1}{1 + \beta + \beta/\epsilon_{eg}}$$ in the case of export goods and

$$\frac{1}{1 + \beta - \beta/\eta_{mj}}$$ in the case of import goods.

Even though the revenue premium is identical for all goods in the economy, the revenue tariff for a particular good will depend on the domestic elasticity of export supply or the domestic elasticity of import demand for that good.

For export goods, the direction of price adjustment is unambiguous: so long as the revenue premium is positive, the revenue multiplier is less than one, indicating a lower domestic price--i.e., an export tax. From the revenue standpoint the lower after-tax price not only reduces the amount which must be paid to export producers per unit of output but also reduces the supply of exports--and hence the quantity base on which the government must make payments. Taxes should be highest on those export goods with the least elastic supplies, since lower prices to their producers conserve government revenue with the least reduction in dollar export earnings.*

*These points each follow from the relevant terms of Equation (18), which says that the social marginal cost of increased export production ($dC/de_g = p_g$) must be multiplied by $(1 + \beta + \beta/\epsilon_{eg})$. The weight of one on p_g covers the real private cost of increased output, while the revenue costs--weighted by β--are approximated by $p_g + p_g/\epsilon_{eg}$. The first term recognizes that the real cost of increased export production is also a revenue loss, since it must be paid to producers. The second term--equal to $dp_g/de_g \; e_g$--recognizes the additional money cost (across all e_g) when increased exports are induced through domestic price increases. The less elastic the supply curve, the greater will be this cost. Thus, from a revenue standpoint a low elasticity dictates a lower price (higher tax).

For import goods we have the rather surprising result that a positive revenue premium may dictate either a tax or a subsidy.* If import demand for a good is inelastic, a higher import price (higher tariff) will favor revenues by increasing the total amount importers of that good will pay out for foreign exchange. If import demand is elastic, however, increased revenue from the sale of foreign exchange will be generated by a lower import price--brought about either through a lower tax or a higher subsidy.**

The logic of the revenue subsidy may be seen in a simple economy whose exports are fixed but impossible to tax. Let it have two totally imported goods, both with fixed and identical world prices, but one with highly inelastic the other with highly elastic, domestic demand. If all three welfare premiums are zero, no tariffs will be indicated. A positive revenue premium, however, implies that the government should raise some revenue (to spend on non-traded goods). It may do so at the least private cost by simultaneously imposing a

---

*While it has long been observed that there is a point beyond which some taxes offer a negative yield--see, for example, Smith [(1789), p. 832]--the suggestion here is that for some imports that point may have been reached even before the tax has been levied.

**We need not be concerned about the perverse case in which $1 + \beta \quad \beta/\eta_{m_j}$ and a negative price would seem to be indicated for a particular importable. In the first place, recall that η is larger than a consumption demand elasticity since it includes the impact of price on domestic supply as well as on domestic demand. In the second place, a negative price is an impossible solution, since the elasticity term itself is defined as positive only with a positive price. In the third place, the denominator of the price expression would be negative only when

$$\eta m_j = \frac{-dm_j/m_j}{dp_j/p_j} \leq \frac{\beta}{1+\beta} \leq 1, \text{ or } -dm_j p_j \leq \beta\,(dp_j m_j + dm_j p_j).$$

In other words, not only would net government revenue from imports increase as the price of imports was raised ($dp_j m_j > -dm_j p_j$), but it would increase so much that its welfare value (the right-hand side of the inequality) would be greater than the value of the reduction in imports at the optimal market price (the left-hand side). So long as this condition prevailed, indefinite price increases would be justified. If, however, there existed some finite price which could reduce consumption of the good to zero, demand would eventually have to become elastic; and even if demand never became elastic, prolonged price (and hence government revenue) increases would eventually drive down the revenue premium, and hence the value of $\frac{\beta}{1+\beta}$.

large tariff on the good in inelastic demand and offering a small subsidy for the good in elastic demand. The balance of payments constraint will be unaffected so long as the reduction in imports induced by the tax is the same as the increase in imports induced by the subsidy. Revenue will be increased because importers of both goods will be paying more in domestic currency than they were previously for the same total amount of foreign exchange. As the example suggests, a revenue subsidy for particular imported goods makes sense only in the context of revenue taxes for other goods.*

III. Separate Prices for Production and Consumption

We have assumed in the previous section that a single domestic price (p_i) must be made effective to both the producers and the consumers of each commodity. This would be justified if (1) there were infinite social costs in separate taxes on the domestic consumption and production of goods in traded categories and (2) the marginal administrative and political costs of all other forms of domestic taxation exceeded those of taxation of exports and imports by the amount β. In this section we explore an alternative assumption: that there are equal marginal administrative-political costs for all taxes on goods in the categories which are traded internationally--whether levied on production, consumption, or trade--but that all other taxes entail marginal social costs (allocative and distributional as well as administrative and political) which exceed these by β per unit of revenue raised.

Introducing the possibility of domestic taxes on traded goods enables us to seek separate optimal prices to producers ($\hat{p}_j$, $\hat{p}_g$) and to users ($\bar{p}_j$, $\bar{p}_g$), since a purely domestic subsidy (e.g., for production) or tax (e.g., on con-

*Since the same revenue premium applies to every traded good in the economy, changes in β (unlike changes in an individual α_i or γ_i) can substantially influence both the equilibrium exchange rate and the market price of factors and hence can shift the prices of all exportables and importables upward or downward. To these extents our conclusions as to the impact of β on prices might have to be modified.

sumption) may now drive a fiscal wedge between the two kinds of prices. Our analysis should be viewed in the context of repeated findings (using geometric methods) that, in Johnson's words, when "there is no cost attached to the choice between a tax and a subsidy," then:

> the only valid argument for protection as a means of maximizing economic welfare is the optimum tariff argument; all other arguments for protection of this kind are in principle arguments for some form of government intervention in the domestic economy.*

In place of the earlier Equations (2), (3) and (5), which treated the domestic production and consumption of a particular good as responding to the same price (p_i), we now have:

$$(2a) \quad c_i = c_i(\bar{p}_i);\ q_i = q_i(\hat{p}_i);\ m_i = m_i(\bar{p}_i, \hat{p}_i)$$

$$(3a) \quad dq_i/d\hat{p}_i > 0;\ dc_i/d\bar{p}_i < 0$$

$$(5a) \quad dC_i/dq_i = \hat{p}_i;\ dB_i/dc_i = \bar{p}_i$$

The easiest way to represent total revenue is to see the government as collecting the difference between the prices users pay for the goods they consume and the prices producers are paid for the goods they produce.** Revenue may then be expressed as:

$$(6a) \quad R = \sum_i [\bar{p}_i c_i - \hat{p}_i q_i]$$

The welfare term to be maximized thus becomes:

$$(15a) \quad V = \sum_i [B_i(c_i) + \gamma_i c_i + \alpha_i q_i + \beta [\bar{p}_i c_i - \hat{p}_i q_i] - C_i(q_i) - \lambda \pi_i mi]$$

Differentiating with respect to λ and to a typical $\bar{p}_i$ and $\hat{p}_i$, we obtain the balance of payments constraint ($M = E$), the optimal prices to consumers

---

*Johnson [(1965), p. 7, p. 5]. For an earlier treatment, see Bhagwati and Ramaswami (1963).

**If we assume that all markets are cleared, this treatment is justified. The same revenue term may also be derived indirectly through conventional terms for taxes and subsidies, when these are assumed to be the only interventions between the prices paid by consumers and received by producers.

and to producers of typical importables:

$$(17a)\quad \bar{p}_j = \frac{\lambda\pi_j\,(1 + 1/\epsilon_{mj}) - \gamma_j}{1 + \beta - \beta/\eta_{cj}}$$

$$(17b)\quad \hat{p}_j = \frac{\lambda\pi_j\,(1 + 1/\epsilon_{mj}) + \alpha_j}{1 + \beta + \beta/\epsilon_{qj}}$$

and the optimal prices to consumers and to producers of typical exportables:

$$(18a)\quad \bar{p}_g = \frac{\lambda\pi_g\,(1 - 1/\eta_{eg}) - \gamma_g}{1 + \beta - \beta/\eta_{cg}}$$

$$(18b)\quad \hat{p}_g = \frac{\lambda\pi_g\,(1 - 1/\eta_{eg}) + \alpha_g}{1 + \beta + \beta/\epsilon_{qg}}$$

where $1/\eta_{ci} \equiv -\dfrac{c_i/p_i}{dc_i/dp_i}$, or the reciprocal of the domestic consumption demand elasticity for a category of goods,

and $1/\epsilon_{qi} \equiv \dfrac{q_i/p_i}{dq_i/dp_i}$, or the reciprocal of the domestic production supply elasticity for a category of goods.

A) Without revenue premium

If we assume no revenue premium ($\beta = 0$), the denominators of each of the four price equations become equal to one, and we may consider their numerators alone. Each domestic price then consists of the world price converted at the equilibrium exchange rate and two tax (or subsidy) elements: a terms-of-trade expression and a premium for either consumption or production.

The terms-of-trade element again calls for a higher price for import goods and a lower price for export goods, and the size of the element is identical for the producers and the consumers of a given good. In the (more empirically relevant) case of exports, the reduction in price is designed to induce exportation only to the point at which marginal revenue on the world market equals the opportunity cost of increased exports, and that cost should be equal whether incurred through additional domestic production or reduced domestic consumption.

The ability to levy separate taxes on producers and consumers may be seen as providing an additional policy instrument enabling one price to be

moved toward its optimal level without incurring the social cost of moving the other price away from its optimal level. Thus, as the equations indicate, the production (or consumption) premium should now be added to (or subtracted from) the domestic price at its full value. It is no longer necessary to modify the protection afforded producers in order to take account of adverse consumption effects, or to modify the stimulus offered consumers in order to take account of any adverse production effects.

These particular results, then, support the conclusion of Johnson (and others) that, in the absence of a concern over revenue and with full freedom to choose among taxes, only terms-of-trade problems justify taxes on trade, while purely domestic distortions justify purely domestic interventions.

B) With revenue premium

When we introduce a positive revenue premium ($\beta > 0$), each of the above results is substantially modified. The optimal prices to producers are divided by the expression:

$$1 + \beta + \beta/\epsilon_{qi},$$

where ϵ_{qi} is the elasticity of domestic production, either of importables or of exportables. Since each of the two terms in β is positive, the effect is unambiguously a lower price to producers--a lower subsidy or a higher tax.

The optimal prices to consumers are divided by the more ambiguous expression:

$$1 + \beta - \beta/\eta_{ci},$$

where the η_{ci} terms are the (absolute values of the) elasticities of domestic consumption of importables or exportables. A higher price to consumers may reduce or increase total expenditure on a commodity, according to whether its demand is elastic or inelastic. The revenue premium therefore reduces the optimal price when demand is elastic ($\eta > 1$), and increases it when demand is

inelastic ($\eta < 1$).*

When revenue considerations were ignored, the optimal price to producers of a good exceeded that to consumers by the sum of the welfare premiums on the production and consumption of that good. The clear effect of the revenue premium, however, is to reduce this disparity. The optimal price paid to producers is always reduced, by being multiplied by a term that is never larger than $\frac{1}{1+\beta}$, while the optimal price paid by consumers is altered (whether up or down) by being multiplied by a term which is always larger than $\frac{1}{1+\beta}$. Only if domestic demand and supply both approached perfect elasticity would the revenue multipliers for producer and consumer prices approach each other in size. If, as is commonly alleged, demand and supply responses in underdeveloped economies are typically inelastic, a relatively small revenue premium could be enough to render optimal prices to producers and consumers equal.**

In any event, the strong revenue needs of governments in most such economies imply that the import tariff--perhaps even supplemented, where possible, by a domestic tax on consumption--could easily be a more efficient means of conferring protection than an outright subsidy to producers.

---

*As indicated in Section I, we may safely assume that the equilibrium requirements of $1 + \beta > \eta$ will be met.

**For an importable good, for which the country exerts no world market power and assigns no consumption premium, the optimal price to producers will be greater than the optimal price to consumers only so long as $\frac{\alpha_j}{\lambda \pi_j}$, the protective premium as a share of the world price, is greater than the expression $\frac{1/\epsilon_{qj} + 1/\eta_{cj}}{1 + 1/\beta - 1/\eta_{cj}}$. If both supply and demand are inelastic, the value of this expression will be at least as large as 2β and will approach infinity as the supply elasticity goes to zero or as the demand elasticity goes to its lower limit for a solution, $\beta/1+\beta$. For example, if the revenue premium were 40% and supply and demand curves both had unit elasticity, the production premium would have to be larger than 80% of the converted world price of the good to justify any direct subsidy (in excess of the implicit subsidy generated by the optimal protective tariff.)

C) Theory and policy

Johnson declares the protective tariff illegitimate on the assumption that "there is no cost attached to the choice between a tax and a subsidy." While his logic remains unassailable, our results suggest that two elements of that assumption are both necessary for his conclusion: not only must there be no greater political and administrative difficulties in taxing domestic production and use than in taxing international trade, but also the difficultie of the other forms of domestic taxation must not be so great as to justify a revenue premium.

Johnson himself casts doubt on the relevance of his conclusions when he admits that the assumption ignores "the empirical consideration...that poor countries have considerably greater difficulty in levying taxes to finance subsidies than they have in levying taxes on imports" [(1965), p. 7]. He seeks to justify his approach in two ways, however.

In the first place, he contends that "the effect of a subsidy on one type of production can be achieved by taxes on alternative lines of production."* The difficulty with this argument is that in an open economy the optimal domestic price for a traded good must be defined relative to the world price of that good. Assume that we wish to encourage a producer to employ factors beyond the point at which their marginal cost equals the world price (converted at the equilibrium exchange rate). Taxing his competitors might generate more demand for the producer's kind of product, but that demand could be entirely met through increased imports. If the producer's marginal costs are increasing only raising the tariff or granting a subsidy for his good would permit him

*Bhagwati and Ramaswami [(1963), p. 238] assert the same point: "The contentic that the payment of subsidies would involve the collection of taxes which in practice cannot be levied in a non-distortionary fashion is fallacious. A tax cum-subsidy scheme could always be devised that would both eliminate the estimated divergence and collect taxes sufficient to pay the subsidies."

to expand output.

In the second place, Johnson argues that the difficulty of raising revenue

> is of practical rather than theoretical consequence, and to constitute a case for tariffs requires supplementation by empirical measurement of both the relative administrative costs and the economic effects of the alternative methods of promoting favored industries. [(1965), p. 7-8].

By contrast, we have tried to demonstrate here that even "theoretical" analysis of the dilemmas of development policy need not ignore the budgetary limitations that are the common predicament of all but a few underdeveloped economies. The "practical" problem of actually quantifying an appropriate revenue premium seems, in principle, no greater--and no less important to rational policy-making--than the problem of quantifying the "divergence between domestic prices and domestic opportunity costs," on which Johnson would base a production subsidy. If we transcend the inherent limitations of plane geometry as a means of demonstrating propositions, we may remain "theoretical" and still go beyond Johnson's conclusion that "the imposition of any tax or subsidy on international trade...for the purpose of correcting a domestic distortion...constitutes a violation of Pareto-optimality" [(1965), p. 10]. We can then recognize that the price of maintaining Pareto-optimality in the trade sector--rather than moving to a "second-best" situation which takes account of revenue needs--would be some combination of (1) heavy distortions and administrative costs through the taxation of non-traded goods and (2) an under-allocation of resources to the public sector. Either would be too high a price to pay for a theoretical abstraction.

IV. Intermediate Goods, Escalation, and Effective Protection

In this section we broaden the analysis to include two kinds of goods, intermediate and final, which may include both importables and exportables.

We will again assume that domestic taxation is infinitely costly, so that only exports and imports may be taxed or subsidized. Intermediate goods, denoted h, may in some cases have final uses (c_h), but we assume that they require no other intermediate goods as inputs. Final goods, denoted k, may require intermediate goods for their production but are assumed never to serve as inputs to other goods.

For each final and intermediate good we define a marginal input coefficient, a_{hk}, expressed in physical units and assumed to be fixed for the range of price variation considered.*

For final goods the definition of imports (exports if negative) remains that of Equation (1); imports of intermediate goods, however, are defined as the sum of final and all intermediate demand less domestic production:

$$(1b) \quad m_h = c_h + \sum_k a_{hk} q_k - q_h$$

For each final good we may define the return to value added (pv_k) as a linear function of the price of output and the prices of inputs:

$$(20) \quad pv_k = p_k - \sum_h a_{hk} p_h$$

While domestic consumption will still respond to the price of the good (p_k), domestic production will be a function of the return to value added**

---

*Alternatively, we might have defined the input-output relationship as fixed in value terms, or defined a continuous production function with each input treated as a factor pf production, as do Ramaswami and Srinivasan (1968). Either of these approaches, however, would permit substantial variation in the physical relationships in response to tariff-induced changes in relative prices, whereas for many final goods there are severe limitations within which economies in materials use can occur.

Note that there are no numerical restrictions on our input coefficient; if the final good k is an automobile and the intermediate good h is a tire, $a_{hk} = 4$. A zero value for a particular a_{hk} will also be common.

**See, for example, Corden (1966), p. 224.

A profit-maximizing, competitive producer will equate the marginal cost of the primary factors of production to that return, which must be positive for domestic production to occur:*

$$(2b) \quad q_k = q_k\ (pv_k)$$

$$(5b) \quad dC_k/dq_k = p_k - \sum_h a_{hk}p_h > 0$$

Our welfare function now becomes the sum of the contributions that the two kinds of goods make to benefits and costs, plus λ times the balance payments constraint:

$$(15b) \quad V = \sum_h [B_h(c_h) + \gamma_h c_h + \alpha_h q_h + \beta p_h m_h - C_h(q_h) - \lambda\pi_h m_h]$$

$$+ \sum_k [B_k(c_k) + \gamma_k c_k + \alpha_k q_k + \beta p_k m_k - C_k(q_k) - \lambda\pi_k m_k]$$

We should recognize, however, that the production premiums on final goods (α_k) now ordinarily refer only to the value added in final production and, other things equal, should be smaller in relation to world prices for goods with heavier intermediate goods requirements.

A) Optimal prices

In maximizing the welfare function we simplify the bookkeeping in two ways. First, we assume that we are dealing with a particular input which serves only one output good in the economy and with a particular final good which uses only that single input. Second, we assume that world prices of all goods are fixed:**

$$(8b) \quad d\pi_h/dm_h = d\pi_k/dm_k = 0$$

---

*This is the form in which we express the familiar restriction on Leontief coefficients.

**Nothing in the way the problem has been framed necessitates these assumptions. The effects of relaxing the first are noted in footnotes below.

Maximizing (15b) with respect to the price of a particular final importable good, k, we obtain:

$$(21)\quad p_k = \frac{\lambda\pi_k - \gamma_k \dfrac{dc_k/dp_k}{\partial m_k/\partial p_k} + \alpha_k \left|\dfrac{\partial q_k/\partial p_k}{\partial m_k/\partial p_k}\right| + [p_h + \beta p_h - \lambda\pi_h]\, a_{hk} \left|\dfrac{\partial q_k/\partial p}{\partial m_k/\partial p}\right|}{1 + \beta - \beta/\eta_{mk}}$$

where $1/\eta_{mk}$ again equals the reciprocal of the domestic elasticity of import demand. If the particular final good k is an exportable, we obtain:

$$(21a)\quad p_k = \frac{\lambda\pi_k - \gamma_k \dfrac{dc_k/dp_k}{\partial e_k/\partial p_k} + \alpha_k \left|\dfrac{\partial q_k/\partial p_k}{\partial e_k/\partial p_k}\right| + [p_h + \beta p_h - \lambda\pi_h]\, a_{hk} \left|\dfrac{\partial q_k/\partial p_k}{\partial e_k/\partial p_k}\right|}{1 + \beta + \beta/\epsilon_{ek}}$$

where $1/\epsilon_{ek}$ again equals the reciprocal of the domestic elasticity of export supply.*

It is in the final term of the numerators of the two equations that we may see the influence of the intermediate good h on the optimal price of the final good. To the extent that reduced imports (increased exports) of the final good are effected through increases in its domestic production $\left(\frac{\partial q_k/\partial p_k}{\partial m_k/\partial p_k}, \frac{\partial q_k/\partial p_k}{\partial e_k/\partial p_k}\right)$, and to the extent that those increases in domestic production induce increased imports of the intermediate good (a_{hk}),** the welfare implications of those imports must be considered. The net gains per unit of additional imports are: the marginal value to producers, assumed to equal the domestic price (p_h); less the foreign exchange cost of importing ($\lambda\pi_h$); plus the revenue premium on the additional revenue (βp_h).

---

*Equations (21) and (21a) could be modified to take account of multiple inputs to the final good k simply by summing the final term across all relevant intermediate goods h.

**All increased requirements for final goods production will be met through increased imports of intermediate goods, since any domestic production or final use of the intermediate good are functions only of its own price.

The relationship between the two kinds of tariffs can be seen more explicitly if we assume away the revenue premium. Producers of final goods should then be allowed to pass on to domestic consumers a fraction, $\frac{\partial q_k/\partial p_k}{\partial m_k/\partial p_k}$ or $\frac{\partial q_k/\partial p_k}{\partial m_k/\partial p_k}$, of the tariffs they have paid on the intermediate goods used in a unit of production, $a_{hk}(p_h - \lambda\pi_h)$. Only if domestic consumer demand for the final good were perfectly inelastic* --so that the higher price would entail no consumption costs--should producers be permitted to pass on to consumers the full amount of the tariffs they had paid.

Maximizing the welfare function in (15b) with respect to the price of a particular importable intermediate good, h, we obtain:

$$(22)\quad p_h = \frac{\lambda\pi_h - \gamma_h \frac{dc_h/dp_h}{\partial m_h/\partial p_h} + \alpha_h \left|\frac{dq_h/dp_h}{\partial m_h/\partial p_h}\right| + [p_k - \lambda\pi_k + \beta p_k - \alpha_k] \left|\frac{\partial q_k/\partial p}{\partial m_h/\partial p}\right.}{1 + \beta - \beta/\eta_{mh}}$$

where $1/\eta_{mh}$ again equals the reciprocal of the domestic import demand elasticity for the good.

Maximizing with respect to the price of a particular exportable intermediate good, we obtain:

$$(22a)\quad p_h = \frac{\lambda\pi_h - \gamma_h \frac{dc_h/dp_h}{\partial e_h/\partial p_h} + \alpha_h \left|\frac{dq_h/dp_h}{\partial e_h/\partial p_h}\right| + [p_k - \lambda\pi_k + \beta p_k - \alpha_k] \left|\frac{\partial q_k/}{\partial e_h/}\right.}{1 + \beta + \beta/\epsilon_{eh}}$$

where $1/\epsilon_{eh}$ again equals the reciprocal of the domestic export supply

---

* Or, as in the case of a pure export, zero.

elasticity for the good.*

The potential impact of a higher price for the intermediate good on the domestic production of the final good is recognized in the final term in the numerator of both price expressions. To the extent that reduced imports of the intermediate good are accompanied by reduced domestic production--and hence increased imports--of the final good $\left(\frac{\partial q_k / \partial p_h}{\partial m_h / \partial p_h}, \frac{\partial q_k / \partial p_h}{\partial e_h / \partial p_h}\right)$ the welfare implications of that shift must be considered. For each unit of domestic production replaced there is the gain of the private cost to producers, assumed equal to the domestic price (p_k), and the loss of the production premium (α_k). For each unit of additional imports there is the loss of the foreign exchange expended ($\lambda\pi_k$) but the gain of the revenue benefit from increased importation (βp_k). In particular cases the net effect may be either a gain or a loss.

B) Escalation and effective protection

It has been frequently demonstrated in the recent literature on trade that the common practice of escalating a tariff structure--charging higher rates on finished goods than on raw materials and intermediate goods--permits "net" or "effective" rates of protection on the value added to final goods to exceed the nominal rates levied on the goods themselves.** At the

*Introducing relationships to multiple final goods would force us to consider both the impact of a higher price of a particular intermediate good in reducing domestic production of all the final goods with which it was linked and the impact of that reduced domestic production in reducing imports of all other intermediate goods with which those final goods were linked. Thus the bracketed final expression would have to be summed over all final goods k and expanded to include an expression, summed over all other complementary intermediate goods, $a_{hk}[\lambda\pi_h - p_h - \beta p_h]$. The tariff term, $\lambda\pi_h - \beta p_h$, would permit the reduced imports of other intermediate goods to be valued at their foreign exchange costs rather than their domestic prices, while the βp_h term would recognize the loss in revenue from reduced imports of those goods.

**See, for example, Johnson (1964), pp. 19-22; Corden (1966), pp. 222-3.

same time there is little discussion and less consensus on the merits of underdeveloped economies persisting in this practice.* Our results, however, permit us to evaluate --at least for some simplified cases--the optimal degree of "effective protection" and whether or not it entails an escalated tariff structure.

1) Purely imported inputs

We assume here that the final good has a single input, one which is entirely imported and which has no other final or intermediate uses in the economy. Thus:

$$c_h = q_h = 0$$

We consider the case--common enough in underdeveloped economies--in which there may be two reinforcing justifications for a tariff on the final good: it is a luxury good whose consumption is to be discouraged, and there are externalities in its domestic production. Thus:

$$\alpha_k \geq 0; \quad \gamma_k \leq 0$$

Solving equations (21) and (22) simultaneously,** we obtain:

---

*Corden [(1966), p. 229] implies that escalation merely disguises a dubious practice: its attraction to protectionists, he comments, is that "the degree of protection provided to industries is not so obvious." Macario [(1964), pp. 83-85], while decrying the degree of escalation common in Latin America, argues that some is necessary to protect infant manufacturing industries; within the manufacturing sector, however, he advocates a "uniform level of net protection." Harberger [(1969), pp. 21-22] also advocates uniform effective protection in order to provide "equal protection to the use of domestic resources in all activities," but suggests that it be achieved through a uniform tariff for both final goods and imported inputs. (He explicitly ignores consumption costs in his analysis.)

**The solution takes advantage of the fact that, under the assumptions, $\frac{\partial q_k / \partial p_h}{\partial m_h / \partial p_h} = \frac{1}{a_{hk}}$. It also entails division by $\frac{dc_k/dp_k}{\partial m_k/\partial p_k}$, and is therefore valid only when there is domestic consumption of the final good which is to some degree responsive to price changes.

(23)
$$p_k = \frac{\lambda\pi_k + |\gamma_k|}{1 + \beta - \beta/\eta_{ck}}$$

where $1/\eta_{ck} = - \frac{c_k/p_k}{dc_k/dp_k}$, and:

(24)
$$p_h = \frac{\lambda\pi_h - \frac{\alpha_h}{a_{hk}} + \frac{|\gamma_k|}{a_{hk}} + \frac{\beta}{a_{hk}} \left[\frac{c_k}{|dc_k/dp_k|} + \frac{q_k}{dq_k/dp_k}\right]}{1 + \beta}$$

The expression in world prices corresponding to pv_k, the return to value added in the final good, we may denote as πv_k, the foreign exchange cost of importing the final good rather than importing the intermediate good and processing it domestically:*

(25) $\lambda\pi v_k \equiv \lambda\pi_k - \sum_h a_{hk} \lambda\pi_h$

Solving Equations (23) and (24) for the domestic return to value added, we obtain:

(26)
$$pv_k \equiv \frac{\lambda\pi v_k + \alpha_k}{1 + \beta + \beta \frac{q_k/pv_k}{\partial q_k/\partial pv_k}}$$

where the term $\frac{q_k/pv_k}{\partial q_k/\partial pv_k}$ is the reciprocal of the elasticity of domestic production with respect to the return on value added.

What is striking about these results is that the premium on the production of the final good, α_k, is nowhere reflected in the optimal price of the final good. It is, however, fully reflected in the optimal return to value added, but realized here entirely through reductions in the optimal price of the intermediate good.

---

*Note that this domestic cost is not dependent on the input-output coefficients that actually prevail in other parts of the world, although world prices themselves may be influenced by those coefficients.

The relationships among the prices are seen more clearly when we assume away the revenue premium. In this case we have:

$$(23a) \quad p_k = \lambda\pi_k + |\gamma_k|$$

$$(24a) \quad p_h = \lambda\pi_h + \frac{|\gamma_k| - \alpha_k}{a_{hk}}$$

$$(26a) \quad pv_k = \lambda\pi v_k + \alpha_k$$

Under these particular assumptions, then, the optimal degree of effective protection--the proportionate increase in domestic value added over the resulting savings in foreign exchange--is uniform for all goods for which the production premium bears the same ratio to value added in world prices. In one extreme case, when there is no consumption penalty or premium ($\gamma_k = 0$), the price of the final good equals the world price, while the price of the intermediate good falls short of the world price by the amount $\frac{\alpha_k}{a_{hk}}$, or the share of each unit of the intermediate good in the production premium on the final good. Thus, a subsidy on imports of the intermediat good serves as a means of providing full effective protection on the final good without distorting domestic consumption, as a tariff on the final good would do.*

---

*Are we now arguing that El Salvador should under these assumptions establish as high a rate of effective protection on computers as on textiles? Yes, but only if she can do so through low (subsidized) domestic prices for imported computer components--and if those components would only in fact be imported by a computer manufacturer (or other producers generating comparable external benefits).

There is no guarantee, of course, that the full subsidy could be provided with a positive price for the intermediate good.

The contrasting case occurs when there is no production premium ($\alpha_k = 0$), and the role of the tariff is merely to discourage nonessential consumption. As Equations (23a) and (24a) indicate, the price of the final good should now include a nominal tariff equal to the full size of the consumption penalty. The increase in domestic price however, should not provide any additional incentive to producers; rather it should be completely absorbed through a higher tariff on the intermediate good. In this case the tariff structure will be "de-escalated"--discouraging domestic consumption while providing zero effective protection.*

When we acknowledge the revenue premium, we are not able to tell whether it indicates higher or lower prices for either intermediate or final goods. Equation (23) indicates that the price of the final good will be increased if the elasticity domestic of consumption is less than one and decreased if that elasticity is greater than one. (Thus, for a final import good inelastic domestic demand would justify a revenue tariff, but for a final export good it would justify a revenue subsidy, and vice versa.) The price of the imported intermediate good described in Equation (24) is augmented by a positive term in β in the numerator but reduced by being divided by a denominator of $1 + \beta$, and the net impact depends on the expression as a whole.

We can, however, see an unambiguous impact on the return to value added. Both terms in β in the denominator of Equation (26) are positive, so the effect of a revenue premium is invariably to reduce the amount of

*The ad valorem tariff on the intermediate good is necessarily larger than that on the final good since, if domestic value added is positive, the domestic price of a unit of the intermediate good must be less than $1/a_{hk}$ times the domestic price of the final good. A tariff of $|\gamma_k|$ on the final good must then represent a smaller proportionate increase than a tariff of $|\gamma_k| / a_{hk}$ on the intermediate good.

effective protection below the level indicated by the premium on production, whether this reduction is effected through a lower price on the final good or a higher price on the intermediate good. The result is plausible, since with the revenue premium the government can no longer afford to offer as large a subsidy to deserving producers through the indirect mechanism of the escalated tariff.

2) Production purely for export

Another simplified case is that of the good produced only for export using a single imported input which has no other domestic uses.*

When we maximize the welfare function with respect to either the input or the output price, we obtain an expression [comparable to Equation (26)] which may be written as the return to value added:

$$(26b) \quad pv_k = \frac{\lambda_\pi v_k + \alpha_k}{1 + \beta + \beta/\epsilon_{ek}}$$

The amount of export production--and the derived demand for imports of the intermediate good--are both determined by this return, but there is no unique solution for either p_k or p_h. The reason is straightforward: with a fixed input-output ratio and fixed world prices, each unit of export production will earn a fixed net amount of foreign exchange. The optimal amount of such production--and hence the optimal amount of effective protection--will depend on the production and revenue premiums. With no domestic consumption to be affected by the price of the final good, however, it does not matter whether the protection is provided through the input price or the output price.**

---

*The petroleum refining industries of Singapore and Panama may approximate this case.

**Ramaswami and Srinivasan (1968) analyze a similar case and conclude that all subsidization should be provided through the final-good price. The critical difference seems to be their assumption of completely flexible input-output ratios, so that the net foreign exchange earnings of a unit of export production are not constant.

3) Some qualifications

These results are, of course, limited by the restrictiveness of the assumptions on which they are based. In the first place, if we admit--as in our original equations--the possibility of price-elastic domestic production and consumption of the intermediate good, the case for escalation as a means of providing protection might weaken. Thus, equation (24) will understate the optimal price of an importable input if it has either a negative welfare premium on domestic consumption or--probably of greater empirical importance--a positive premium on domestic production.* Equation (22) indicates that producers should be allowed to pass on some, but probably not all, of a higher input price in the form of a higher price for the final good.

In the second place, we must admit the possibility--discussed above only in footnotes--that a particular final good will have many inputs, and each intermediate good may serve many final goods. A complicated formula would then be required to represent the optimum amount of effective protection to a particular line of production. The simple cases analyzed here, however, do demonstrate how the existence of intermediate goods offers an additional degree of freedom to economic policymakers, one which can reduce the consumption cost of achieving a given degree of protection or minimize the distortions in production entailed in using tariffs on final goods to curtail nonessential consumption.**

---

*For example, it would not be sensible to subsidize automobile assembly through an escalated tariff if the main learning benefits of the industry were obtainable only through the domestic manufacture of components.

**When, as in Equations (23a) and (24a) we ignored the revenue premium we were assuming just the number of policy instruments--two tariffs--required to achieve our objectives--optimal amounts of production and consumption. In a world of highly complex linkages, there must ordinarily be at least as many intermediate goods as there are final goods--and negative prices must not be ruled out--if a first-best solution is to be achieved.

V. Summary and Conclusions

We have attempted to show that the technique of constrained maximization, commonplace in other branches of economics, can be fruitfully applied to the theory of tariffs. Its application requires nothing more than a restatement of some of the conventional assumptions of trade theory and a decision to solve for domestic, after-tax prices rather than for tariffs themselves. The technique can take simultaneous account of more of the objectives of trade policy--including some that are particularly important in underdeveloped economies--than can be considered through partial analysis or plane geometry.

Our results permit us to see the traditional terms-of-trade tariff--or any other tariff to further a single goal, such as protection, income redistribution or government revenue--as a special case of a more general theory. They also shed light on a central dilemma of tariff policy: how to achieve a desired influence on either production or consumption without adversely influencing the other. For terms-of-trade considerations this is no problem, since the optimal influence on price is the same for both consumers and producers. When protection, redistribution or encouragement of investment are the objectives, however, production and consumption goals may easily conflict. Thus, we found that the size of the optimal protective tariff for a good would depend not only on the size of its production premium but also on the relative slopes of its supply and demand curves, since these will determine the relative production benefits and consumption costs of protection. Likewise, the size of a tariff to discourage consumption of a good will depend not only on the consumption premium but also on the relationship between the consumption benefits and production costs of the policy.

We have explored two alternative devices for independently achieving the two effects of a policy. The most direct, where feasible, is the levying of separate taxes on domestic production and consumption, incorporating the full welfare premiums for the respective activities. When, however, tariffs on trade are the only feasible devices, the prices of traded intermediate goods can be manipulated so as to generate independent incentives for production and consumption. These are generated most efficiently when intermediate goods represent a large portion of the cost of production (so that negative domestic prices on inputs are not required) and when they are highly specialized, having few alternative intermediate or final uses. In the extreme case in which there are no alternative uses, differential tariffs on intermediate and final goods can be a perfect substitute for separate domestic taxes (and subsidies) for the production and consumption of final goods.

Revenue considerations affect these conclusions in several ways, some of them unexpected. The revenue component of the tariff appears not as an independently-determined addition to the non-revenue components but as a multiple of that domestic price which would otherwise prevail. For final export goods and for some final import goods, revenue considerations dictate a higher tariff, but for final imports in inelastic demand they may dictate a lower tariff or a subsidy. Even when separate taxes are feasible for the production and consumption of final goods, the effect of a revenue premium is ordinarily to bring their prices closer together--quite possibly to the point where protection is as efficiently provided through a tariff as through a direct subsidy to producers.

Other considerations could be introduced which would modify some of these conclusions. For example, we might recognize quality differences between domestic and foreign goods, or foreign non-price restrictions on export sales; either could introduce some discontinuity between the domestic and export sale of the same good, and hence some dependence of domestic production on domestic consumption.* Likewise, the analysis might be broadened by explicit recognition of non-traded goods, the impact of government expenditure on the demand for traded goods, or the ability of policy measures to convert an import into an export good.

Our particular results, then, should be taken to be illustrative rather than definitive. The important point is that the various strands and concerns of trade theory can be integrated into a single formula for the optimal domestic price--and hence the tariff or subsidy--for a particular traded good. The general framework we have described should be capable of accomodating a wide variety of theoretical assumptions and practical problems.

---

*For example, a tariff on high-speed computers might be a means by which El Salvador could generate a domestic market for desk calculators, the production of which might have important learning benefits.

References

Berg, Elliot J., "Socialism and Economic Development in Tropical Africa," Quarterly Journal of Economics, Nov. 1964, pp. 549-573.

Bhagwati, J. and Ramaswami, V. K., "Domestic Distortions, Tariffs and the Theory of the Optimum Subsidy," Journal of Political Economy, LXXI, No. 1, Feb. 1963, pp. 44-50; reprinted in R. E. Caves and H. G. Johnson, eds., Readings in International Economics, Homewood, Ill., Irwin 1968, pp. 230-239.

Bickerdike, C. F., "The Theory of Incipient Taxes," Economic Journal, Vol. XVI, December 1906, pp. 529-535.

Corden, W. M., "The Structure of a Tariff System and the Effective Protective Rate," Journal of Political Economy, June, 1966, pp. 221-237.

Due, John F., Taxation and Economic Development in Tropical Africa, Cambridge, Mass.: M.I.T., 1963.

Eckstein, Peter C., "Uniform vs. Differentiated Protective Tariffs," Journal of Development Studies, July 1969.

_____, "The Terms of Trade Tariff: A Geometric Representation," unpublished, 1969.

Enke, Stephen, "The Monopsony Case for Tariffs," Quarterly Journal of Economics, February, 1944, pp. 229-245.

Goode, Richard, George E. Lent, and P. D. Ojha, "Role of Export Taxes in Developing Countries," International Monetary Fund Staff Papers, Vol. XIII, No. 3, November, 1966, pp. 453-503.

Graaff, J. de V., "On Optimum Tariff Structures," Review of Economic Studies, Vol. XVII (1), 1949-50, pp. 47-59.

Haberler, Gottfried, International Trade and Economic Development, Fiftieth Anniversary Lectures, Cairo: National Bank of Egypt, 1959.

_____, "Import Taxes and Export Subsidies as a Substitute for the Realignment of Exchange Rates," Kyklos, XX, Fasc 1, 1967, pp. 17-23.

Harberger, Arnold C., "Memorandum on Fiscal Incentives," unpublished, March, 19(

Hicks, Ursula K., Development Finance: Planning and Control, Oxford: Oxford University Press, 1965.

Higgins, Benjamin, Economic Development: Principles, Problems and Policies, revised edition, New York: Norton, 1968.

Hirschman, Albert O., Development Projects Observed, Washington, D. C., The Brookings Institution, 1967.

Johnson, Harry G., "Optimum Welfare and Maximum Revenue Tariffs," Review of Economic Studies, Vol. XIX, 1951-52, pp. 28-35.

_____, "The Cost of Protection and the Scientific Tariff," Journal of Political Economy, Vol. LXVIII, No. 4, August, 1960, pp. 327-34.

_____, "Tariffs and Economic Development: Some Theoretical Issues Journal of Development Studies, Vol. I, October 1964, pp. 3-30.

_____, "Optimal Trade Intervention in the Presence of Domestic Distortions," in Robert E. Baldwin, et al, Trade, Growth, and the Balance of Payments: Essays in Honor of Gottfried Haberler, Chicago: Rand McNally, 1965, pp. 3-34.

_____, "Is Inflation a Retarding Factor in Economic Growth?", in David Krivine, ed., Fiscal and Monetary Problems in Developing States, New York: Praeger, 1967, pp. 121-130.

Kahn, R. F., "Tariffs and the Terms of Trade," Review of Economic Studies, 1947-48, pp. 14-19.

Keynes, John Maynard, et al, "Addendum 1," Report of the Committee on Finance and Industry, London, 1931.

Kindleberger, Charles P., International Economics, 4th edition, Homewood, Illinois: Irwin, 1968; Chapter 7.

Lerner, Abba P., "The Symmetry Between Export and Import Taxes," Economica, New Series, Vol. III, August, 1936; reprinted in Lerner, Essays in Economic Analysis, London: MacMillan, 1953, pp. 123-133.

_____, The Economics of Control, New York: MacMillan, 1944

Macario, Santiago, "Protectionism and Industrialization in Latin America," Economic Bulletin for Latin America, Vol. IX, No. 1, March 1964, pp. 61-10

Martin, Alison M., and W. A. Lewis, "Patterns of Public Revenue and Expenditure," The Manchester School, September, 1956, pp. 203-244.

Meade, J. E., The Balance of Payments, London, Oxford University Press, 1951; Vol. 1, Chapter XX.

Musgrave, Richard A., The Theory of Public Finance: A Study in Public Economy, New York: McGraw-Hill, 1959.

Paauw, Douglas S., "Local Finance in Indonesia," from Financing Economic Development--The Indonesian Case, Glencoe: Free Press, 1960; reprinted in R. Bird and O. Oldman, eds., Readings on Taxation in Developing Countries, Baltimore: Johns Hopkins, 1964, pp. 361-385.

Peterson, John M., and Ralph Gray, Economic Development in the United States, Homewood, Ill.: Irwin, 1969.

Power, John H., "Industrialization in Pakistan: A Case of Frustrated Take-off?", Pakistan Development Review, Summer, 1963, pp. 191-207.

Ramaswami, V. K., and T. N. Srinivasan, "Optimal Subsidies and Taxes When Some Factors are Traded," Journal of Political Economy, Vol. 76, No. 4 Part I, July/August, 1968, pp. 569-582.

Roe, Alan R., "The Government Revenue Share in Poorer African Countries--A Comment," Economic Journal, June, 1968, pp.

Scitovsky, Tibor, "A Reconsideration of the Theory of Tariffs," Review of Economic Studies, IX, (2) Summer, 1942, pp. 89-110; reprinted in Readings in the Theory of International Trade, Philadelphia: Blakiston, 1949, pp. 358-389.

Smith, Adam, The Wealth of Nations, 5th edition, 1789; New York: Modern Library, 1937.

Tanzi, Vito, and Clayton McCustion, "Determinants of Government Revenue Shares Among Less-Developed Countries: A Comment," Economic Journal, June, 1967, pp. 403-405.

Center for Research on Economic Development

CRED Discussion Papers

No. 1 ELLIOT J. BERG, *"Wage Structure in Less Developed Countries,"* January 1968

No. 2 PETER ECKSTEIN, *"Accounting Prices as a Tool of Development Planning,"* February 1968

No. 3 WOLFGANG F. STOLPER, *"Economic Growth and Political Instability in Nigeria: On Growing Together Again,"* November 1968

No. 4 ELLIOT J. BERG, *"Industrial Relations Systems in Colonial West Africa: A Comparative Analysis of French West Africa and the Gold Coast,"* December 1968

No. 5 ELLIOT J. BERG, *"Trade Unions and Wage Levels—The Nigerian Case,"* January 1969

No. 6 RICHARD C. PORTER, *"Some Implications of Post-War Primary Product Trends,"* February 1969

No. 7 PETER ECKSTEIN, *"Quantitative Measurement of Development Performance: A Critique by Peter Eckstein and a Reply by Irma Adelman and Cynthia Taft Morris,"* April 1969

No. 8 RICHARD C. PORTER, *"The Effectiveness of Tax Exemption in Columbia,"* July 1969

No. 9 PETER ECKSTEIN, *"Toward an Integrated Theory of Tariffs,"* August 1969


BRODART
MADE IN U.S.A.